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AIDS AND APPLIANCES REVIEW

THE CARROLL CENTER FOR THE BLIND
770 Centre Street, Newton, MA 02158
(617)969-6200

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Issue No.3
Editor: Robert McGillivray

INTRODUCTION

The following review of handwriting guides for the visually impaired was prepared in part by Maureen Ecker of the Massachusetts Commission for the Blind, with the assistance of Nancy Campbell and Elizabeth Gipson of the Carroll Center for the Blind. We gratefully acknowledge the following agencies for generously contributing their expertise: Arkansas Enterprises for the Blind, Massachusetts Association for the Blind and the Texas State Commission for the Blind. We would also like to extend special thanks to Frances Weiss of the Massachusetts Association for the Blind for her editorial assistance.

HANDWRITING GUIDES

Among the most common modes of communication in everyday living is the handwritten word. Whether one is communicating to a relative, friend or business associate, handwriting — its visual effect and legibility — is an expression of one's self. Hours and years of practice and use help to develop a style which is unique to each individual and yet conforms to a myriad of different sized lines and spaces on countless applications, financial documents and business forms. Correspondence lacks validity and authority without a proper signature. Therefore, if a person has lost the ability to sign his own signature or write his own letter, he may feel that he has lost that validity and authority.

For the visually impaired person handwriting poses a constant frustration. Keeping letters and words on lines, clearly shaped and distinguishable, cannot be taken for granted when one cannot see. For the vast majority of visually impaired individuals, handwriting is a skill that was learned visually. When one can see, it is not necessary to concentrate on closing the letter *a* and the letter *o* or crossing the letter *t*. It is also not a problem to tell when the word being written is creeping up and off the line or paper or if the word fits within the desired space. The lines, size and shape of the paper provide a constant visual reference which the sighted person uses unconsciously to make accommodations in the size and form of the letters and in the spacing and the slant of the name. The blind or visually impaired person has lost the ability to utilize his sight to verify his writing. The tendency of the visually impaired person is to write larger, less well-defined letters. Without assistance, it is often impossible to tell if he is writing on top of other writing or if the words are conforming to the space or line allocated for them. For example: ask a sighted person to write his name using his vision and then to close his eyes and write it again beneath the first signature. The comparison illustrates the difficulty of writing without sight.

As in many other areas of common everyday activities, visually impaired or totally blind persons must re-learn how to accomplish simple tasks. The secret to success is to find and apply a method appropriate to the individual's age, capability and personality. Many different techniques, as well as handwriting aids and guides, have been developed to ease the frustrations of handwriting for visually impaired persons.

Handwriting guides for a wide variety of uses can be roughly divided into six categories: rigid guides, flexible guides, commercial templates, bold-lined guides and tactual surface guides.

Rigid Guides

Rigid models of handwriting guides have been developed for general use as well as to give stability and security to the unsure hand. An elderly person who has a weakness or tremor in his hands, or who may have complications due to a stroke, may find this type of guide most supportive. A congenitally blind individual may also find that the restricted area to which he is limited by such a guide best defines the space in which to write.

The rigid models usually utilize raised metal rods or a thick cut-out which covers the area of paper on which it is to be written or signed. The guide may have a rubber backing to prevent slippage or incorporate a clipboard to keep the paper in place. The area encompassed by the rods or cut-out is well defined and inflexible, giving stability, but in so doing constricts the field of writing. The formation of certain letters may be difficult and cramped, especially letters with descenders, such as *y* or *g*.

Flexible Guides

Flexible handwriting guides are designed to allow more freedom of motion for the writing implement, thereby giving more flexibility for the formation of letters, especially letters with descenders.

Flexible guides use plastic or elastic strings to guide one's writing, allowing the trained user to fully form all of his letters. Since the strings may be moved while writing, they do not give stability to the unsure hand. The strings are usually black, providing contrast for visual guidance to some partially sighted users.

Commercial Templates

Templates utilize an age-old concept of defining the space to be used by cutting out the proper openings on some type of material. They usually have specially designed cut-outs that are aligned to the areas in which specific handwritten information is necessary. These guides are usually made out of material such as rigid cardboard, plastic, aluminum or vinyl.

Homemade Templates

The homemade guides use the template concept and are made to suit one's own particular need. They are designed to fit one's own check style or envelopes, or to accommodate the size of one's own signature. The ability to make a homemade guide or have one made eliminates the time and expense of ordering a commercial guide. The range and variety of guides are as wide as the range of one's creativity. Homemade guides are discussed in depth on page 13 of this Review.

Bold-lined Guide

For the individual with a certain amount of useful residual vision, the bold-lined handwriting guide can give some measure of visual guidance. A thick black line underlining the area which is to be signed or written on can give a low vision person some level of independence in handwriting tasks. There is a wide variety of bold-lined paper available, as well as checks which have bold black lines under all lines to be written upon. Bold-lined material can be printed by a local printer to meet one's own particular needs. An individual can also have a family member or friend draw bold black lines on the material to be used with a black felt-tip pen or other black marker.

Tactual Surface Guides

Tactual surface guides are devices which use either a raised line, or a ribbed or grooved surface, to give the user information about the layout and format of the material on which he is writing. Raised-line paper has the tactual surface incorporated into the writing material itself. The grooved or ribbed writing board is a surface on which the paper is placed and through which the tactual lines can be felt. One homemade method to create a tactual surface is to fold the material to be written on so that the folds or creases indicate the areas in which to write.

This Review will address the handwriting needs, techniques and resources that are known to us in the areas of signature writing, full-page writing, envelope addressing and check writing. We will discuss simple techniques and give a listing of known resources. The distributors listed may not be the only sources for a given aid, but they do distribute aids nationally.

The resource listing for each guide includes a description of the guide, its advantages and disadvantages, comments and a photograph. What may be an advantage to one person may be a disadvantage to another. The comments have been gathered from a variety of sources.

Further comments on particular guides and their uses, or on guides not covered in the Review, are welcomed and encouraged. The complete addresses of the manufacturers and distributors are listed at the end.

SIGNATURES

Signatures are usually the most important written words of any individual. Personal and business situations illustrate the importance of a clearly written signature. Signing the dinner check, an application, a receipt for a package and signing a charge card are familiar examples. From a traveler's check to a greeting card to a child's report card, it is the signature which legitimizes and personalizes. The importance of the appearance of one's name, written in one's own hand, is clearly understandable.

Signature Techniques

There are methods and techniques of signature writing which do not require the use of specific guides. A visually impaired person who can accurately shape letters and words in an acceptable size may be able to produce a signature merely by having a sighted person place the thumb and forefinger of the visually impaired person at the beginning and the end of the line on which his name is to be written. The visually impaired person is then able to gain a sense of the angle of the line and its length. He can then sign his name between these reference points. A disadvantage of this method is that it is difficult for some visually impaired persons to write at the correct angle, and the name may often start on the line but end markedly above or below it.

Another simple method is for a sighted person to align a straightedge, such as an index card or a ruler, with the signature line. The visually impaired person then uses this edge as a guideline. This method sometimes produces letters or words which are squared or cut off at the bottom.

For a visually impaired person, signing typed correspondence unaided is a challenge. A former client of the Carroll Center's Rehabilitation Program devised the following method which is taught to appropriate clients, but works only with manual typewriters. Once the proper complimentary closing is typed on a letter or correspondence, the carriage is rolled up six lines and a line of periods is heavily typed beneath this closing. When the letter is removed from the typewriter, one can feel the dots forming the signature line from the back of the paper, thus enabling him to sign or align his guide to write his signature.

Another technique used to place a signature correctly on a typed letter can be accomplished very simply while the letter is still in the machine. This method will work well for any kind of typewriter. Once the complimentary closing has been typed, the typist rolls the carriage up six to eight lines to type his name. The typist now has a blank space between the complimentary closing and his name. Knowing the location of this space while it is in the typewriter, the typist can learn to write his signature while the paper is resting on the roller. The roller presents a somewhat awkward but firm backing for the signer.

Visually impaired individuals with some usable vision may be assisted by darkening the signature line on the material to be signed with a black felt-tip pen or marker. This provides the guidance necessary.

Signature Guides

There are many signature guides available which allow the visually impaired individual greater independence. They generally consist of a large piece of material with a rectangular cut-out. The visually impaired person can feel the size and shape of the opening with his fingers and/or pen, and can adjust the size of his signature accordingly. Although some signature guides are designed so that an outside or bottom edge can be aligned with an edge of the paper, most require a sighted person to place the guide on the line where the signature is to appear. The guides which seem best for general purposes are rubber-backed to reduce slippage and are flexible to allow space for descending letters.

Many of the signature guides are designed and made so that the user can align them properly on a check and thereby sign a check with no assistance. All of the guides can be used quite easily for endorsing checks by signing one's name across the back side of the check.

A signature guide can be made at home by cutting a rectangular shape from a sturdy material using an "X-acto" or other single-edge, razor-type knife. Several types of material have been used successfully for this purpose, including vinyl or foam placemats, plastic document covers, cardboard backing from pads of paper, and masonite. Having the person help to make his own guide can have additional benefits. He can readily make, or instruct someone else how to make, a new guide inexpensively when the need arises.

The person who finds the discussed techniques or following guides unsatisfactory or inconvenient may wish to investigate the use of a commercial signature stamp.

Signature stamps are an alternative to personally signing one's name, and are in common use in business and in banking transactions. For banking purposes, the bank may require that the signature stamp match the signature card issued when accounts are opened. If a person chooses to use a stamp for banking purposes, he should first check with his own bank to see if there are any local regulations concerning these stamps.

SIGNATURE GUIDE RESOURCES

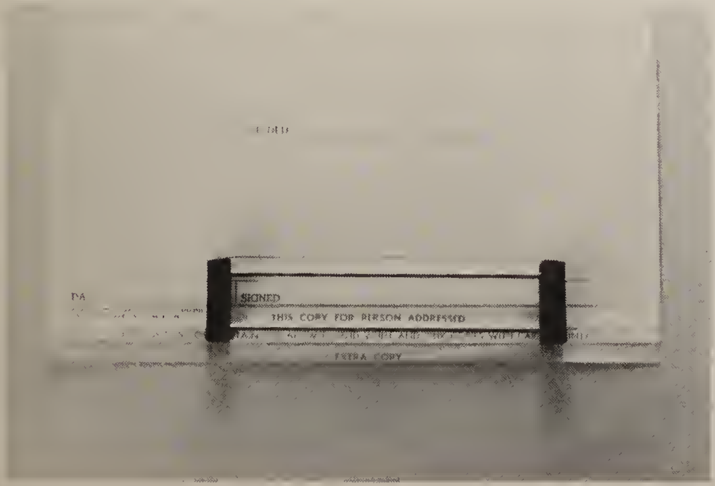
American Foundation for the Blind

Metal Rod Signature Guide **WS 294 — $1.25**

Two rubber blocks support two 4½" lengths of metal rod, 9/16" apart.

Advantages: Rubber prevents slippage. Length of guides accommodates long signatures. Rods give support when necessary.

Disadvantages: Some feel too restricted when writing. Letters can appear stiff and squared off. Rods do not rest on page and therefore may not provide enough structure. Too bulky to carry in wallet.

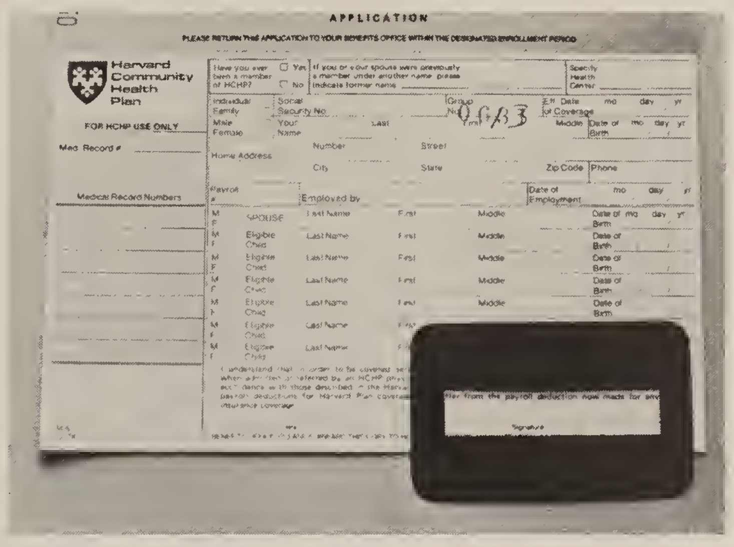


Plastic Signature Guide **WS 267 — $ .50**

Sturdy plastic mask with opening to correspond with a standard signature area. Credit card size (2⅛" x 3⅜") to fit wallet.

Advantages: Durable, flexible and inexpensive.

Disadvantages: Rounded corners make alignment somewhat difficult. Vinyl can melt or warp with prolonged exposure to sun.



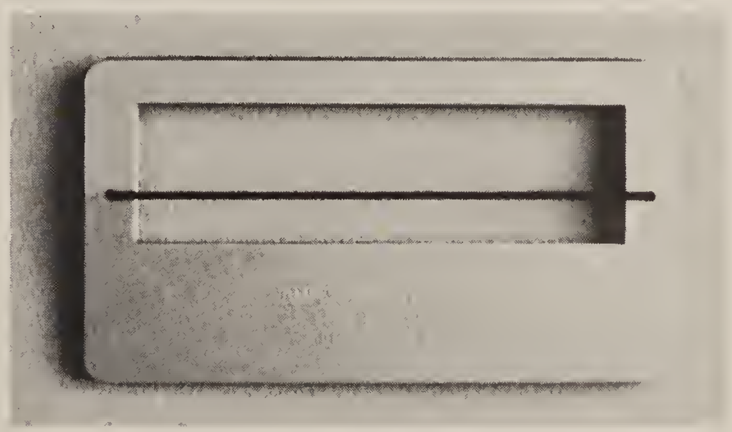
American Printing House for the Blind

Aluminum Frame Signature Guide **$2.25**

Anodized rubber-backed aluminum frame 4½" x 2½" x ⅛", with a cut-out for writing 3½" x 1", with a stretched elastic guideline 5/16" from bottom of cut-out.

Advantages: Sturdy, durable. Rubber prevents slippage. Elastic guidelines allow for descending letters.

Disadvantages: May offer too much flexibility for those who need much structure. Not flexible for carrying in pocket or wallet.



Designs for Vision

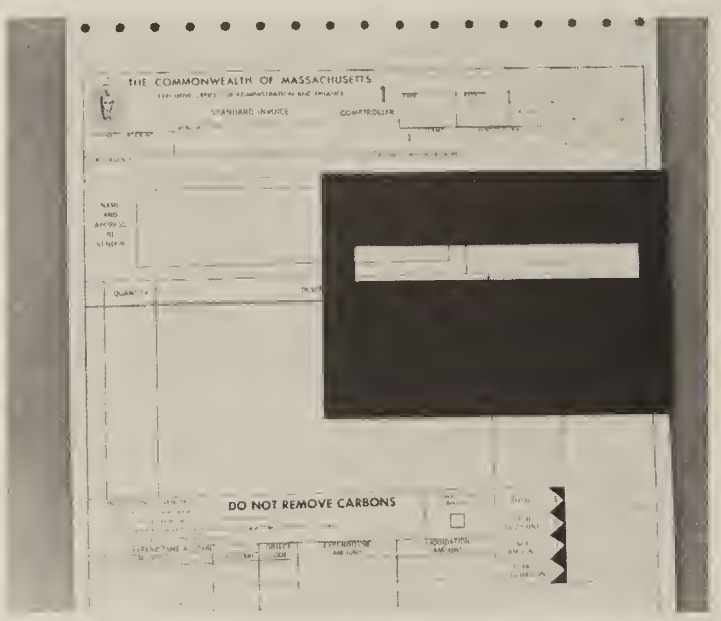
Typoscope $ .50

Black vinyl guide 5″ x 3½″ with a 4″ x ½″ aperture.

Advantages: Non-glare, black surface provides good contrast for low vision. Length of aperture accommodates long signatures.

Disadvantages: Can be slippery. Too large to carry in pocket or wallet.

Comments: The Typoscope is designed primarily as a reading guide but has been found satisfactory as a signature guide.



Hewitt Printing Corp.

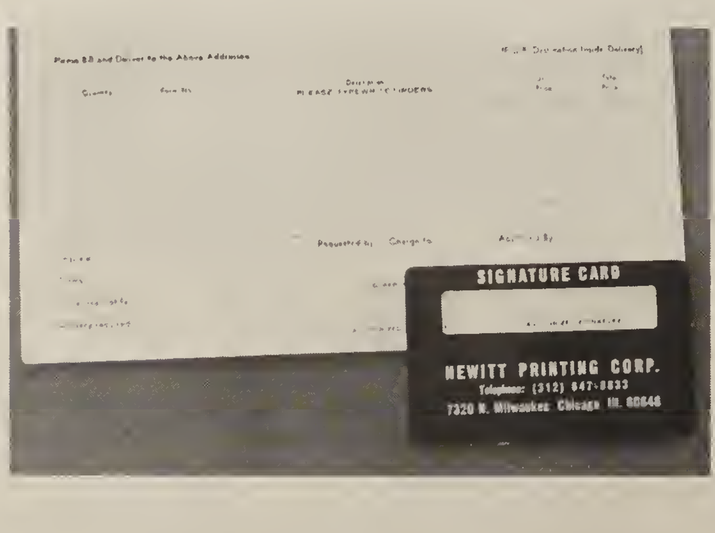
Hewitt Signature Guide 10 @ $.15 ea.

A black cardboard rectangle 2″ x 2½″ with a 5/8″ x 3″ opening cut for signature.

Advantages: Inexpensive. Black background provides good contrast for low vision. Easily carried.

Disadvantages: Not durable. Can tear or bend with use.

Comments: Available only in bulk, minimum order of 50.


SIGNATURE CARD
HEWITT PRINTING CORP.
Telephone: (312) 647-8833
7320 N. Milwaukee Chicago, Ill. 60648

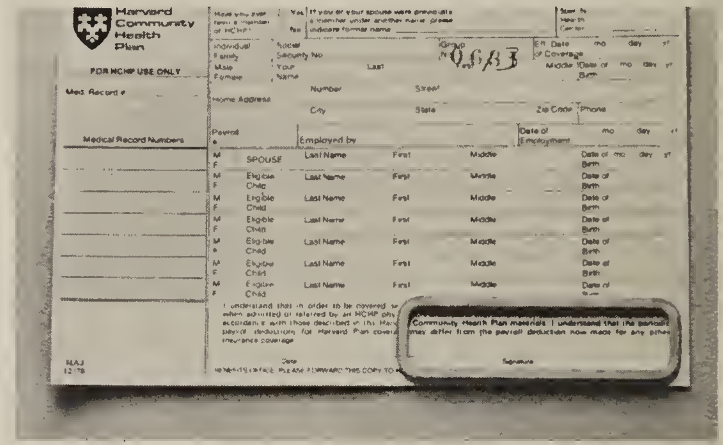
Howe Press

Howe Press Signature Guide $.65

Aluminum frame, 3½″ x 1″.

Advantages: Inexpensive. Can be carried in pocket. Durable.

Disadvantages: Slides on paper if not held firmly. Some find it restricting when writing descending letters. Not flexible for wallet.



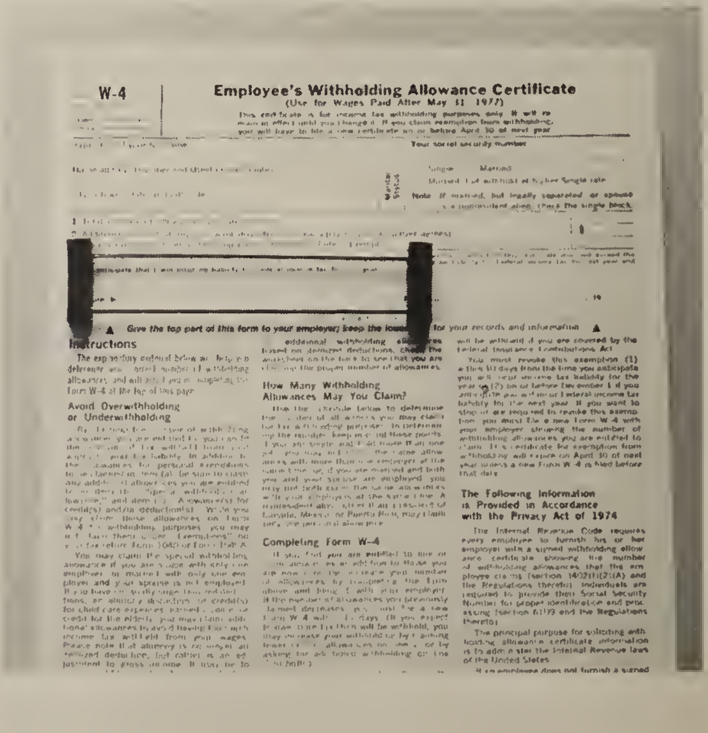
Independent Living Aids

Metal Rod Signature Guide #224850 — $1.15

Two rubber blocks support two 4½″ lengths of metal rod, 9/16″ apart.

Advantages: Rubber prevents slippage. Length of guides accommodates long signatures. Rods give support when necessary.

Disadvantages: Some feel too restricted when writing. Letters can appear stiff and squared off. Rods do not rest on page and therefore may not provide enough structure. Too bulky to carry in wallet.


W-4
Employee's Withholding Allowance Certificate
Instructions
How Many Withholding Allowances May You Claim?
Completing Form W-4
The Following Information is Provided in Accordance with the Privacy Act of 1974

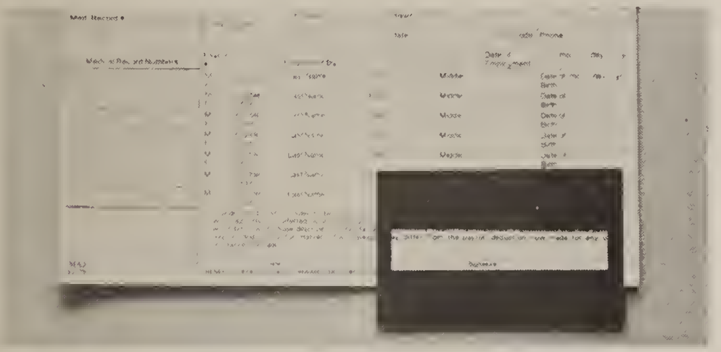
Independent Living Aids

Plastic Signature Guide #692222 — $.40

Sturdy plastic mask with opening to correspond with a standard signature area. Credit card size to fit wallet.

Advantages: Durable, flexible, inexpensive.

Disadvantages: Vinyl can melt or warp with prolonged exposure to the sun.



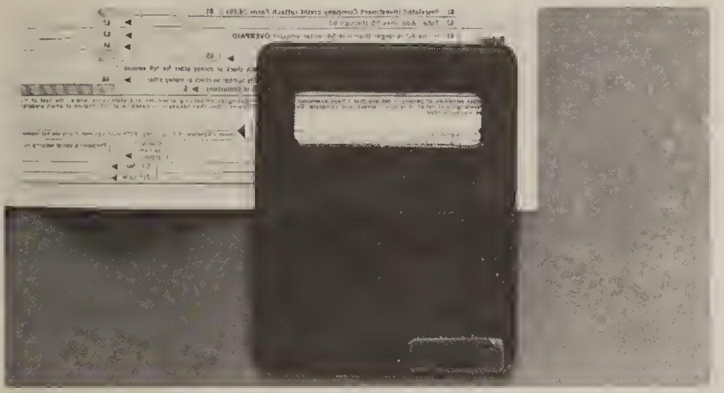
Massachusetts Association for the Blind

MAB Signature Guide $1.00

Folding wallet-sized signature guide made of flexible, durable, non-glare plastic. Has built-in pocket for business and credit cards.

Advantages: Attractive, inexpensive. Can be used to endorse checks. Easily carried.

Disadvantages: Too new to assess.



Spartan Plastic Corp.

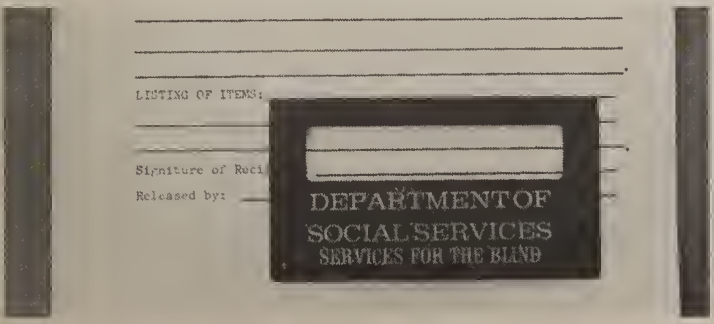
Plastic Signature Guide Set of 4 — $1.80

A black plastic guide 4½″ x 2½″ with a 3/4″ x 3″ opening.

Advantages: Inexpensive, durable, black background provides good contrast for low vision. Non-glare.

Disadvantages: Too large to fit in pocket.

Comments: Set consists of 3 signature guides and 1 full-page guide. Minimum order 250. Other colors available.



Sped Publications

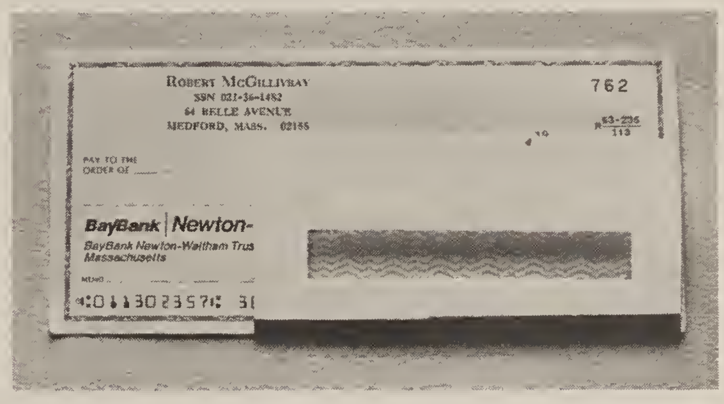
Double Signature Guide $.50

White plastic guide designed for writing signatures on checks. Bottom half folds behind the check so that cut-out space is aligned with signature line on check. May be used for check endorsement.

Advantages: Sturdy, washable, flexible, durable, inexpensive. Fits neatly in wallet.

Disadvantages: White plastic does not provide good contrast for low vision users.

Comments: A strip of black tape placed on the lower edge of the opening will increase contrast. Enclose 15¢ for postage for each guide.



FULL-PAGE GUIDES

For those who cannot type, but who may need to write lists, letters, or whole pages, numerous writing guides and aids are available. The basic concept of these guides is to provide a tactual line on which to write. When writing more than two or three lines, such as with a shopping list or letter, there is a greater possiblity of superimposing and poor spacing.

In addition to keeping words confined to a reasonable space, some handwriting guides incorporate a means for keeping one's place both on the line and from line to line. Most full-page guides are designed to accommodate a standard size 8½″ x 11″ sheet of paper but can be used with smaller paper as well. Full-page writing guides come in a wide variety of types and styles.

Techniques and Guides

Rigid types of guides may be necessary for those congenitally blind who have difficulty conceptualizing lines and space or for those elderly persons who need stability. A common household item which can be substituted for a rigid-type guide is a cake cooling rack. When placed upside down on a sheet of paper, the metal bars create lines and spaces that can be easily felt.

The flexible string writing guides are designed to have the paper inserted under a frame with a series of plastic or elastic strings. The strings are flexible enough to allow movement in forming descending letters. Individuals using this type of guide must have good control over their movements and good orientation.

Template type guides are available commercially and may also be made by cutting spaces out of a sturdy material. There are a variety of ways to prevent the guide from slipping. Some people prefer to paper clip the guide to a cardboard backing; others prefer to hold the guide and paper firmly in place with a clipboard. A paper clip can also be slid from the top to the bottom on the left side of the template to mark the line in use. A paper clip can also be used on the horizontal lines to mark the place where one has left off writing. Template type guides are less expensive than the more sophisticated devices but are also less durable.

The two tactual surface guides use similar concepts. With the first style, the heavy grooved fiberboard or the plastic sheet with raised lines, one can use a paper clip to fasten the paper to the top of the guide so that the sharply defined lines or grooves can be felt through the paper. This enables the trained person to keep his writing in line by continuously feeling the guide lines. The second style is the raised line or embossed line paper. This paper allows the person to keep his writing in line by feeling the lines that are part of the writing surface. A major disadvantage of this paper is that it is very obvious to the person who receives the letter that the paper is specifically designed for use as a guide.

Another tactual technique of full-page writing is to fold a sheet of regular writing paper into a number of horizontal sections which can be felt by the writer. The writer may either fold the paper so that all of the creases are on the same side of the paper or so that they alternate. Some people find that the best method is to have all of the creases facing the writer, whereas others find it best with all of the creases facing down. This would depend on individual preference.

Bold-lined paper is frequently helpful to the visually impaired person who has some useful residual vision. The thick black lines on a white background are spaced farther apart than usual to accommodate a larger script written with a dark felt-tip marker. This paper can be reproduced by drawing thick, dark lines on white paper using a felt-tip marker. A person may find that offset printing his own supply of paper from a sample sheet of high quality, bold-lined paper may be less costly than purchasing it ready made. In this way, too, one is able to design the paper to suit his own preference.

FULL-PAGE WRITING AIDS

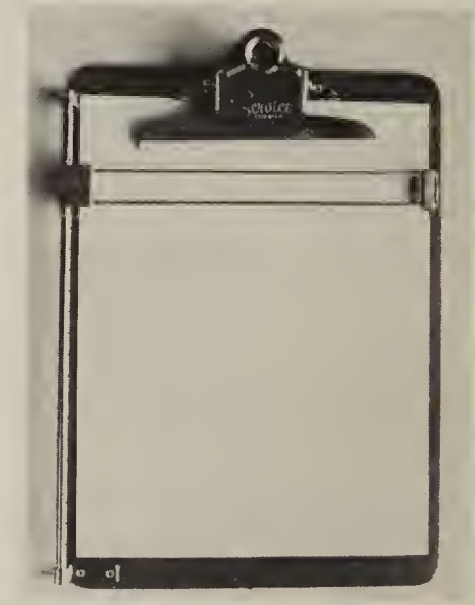
American Foundation for the Blind

Marks' Guide WS-295 — $17.95

Clipboard which holds 8½" x 11" paper allows writing within 3/4" guide which moves down page one line at a time. Notches mark the 17 lines to maintain equal spacing. A single margin stop can be moved to the left or right.

Advantages: Some individuals like the rigidity of the guide bars. Definite spacing is maintained between the lines. Paper is held firmly in place by clip when writing.

Disadvantages: For some individuals, more flexibility when writing is preferred than this guide provides. Does not allow descending letters to be easily written. Bars are raised off paper enough to make hand position awkward. Expensive.



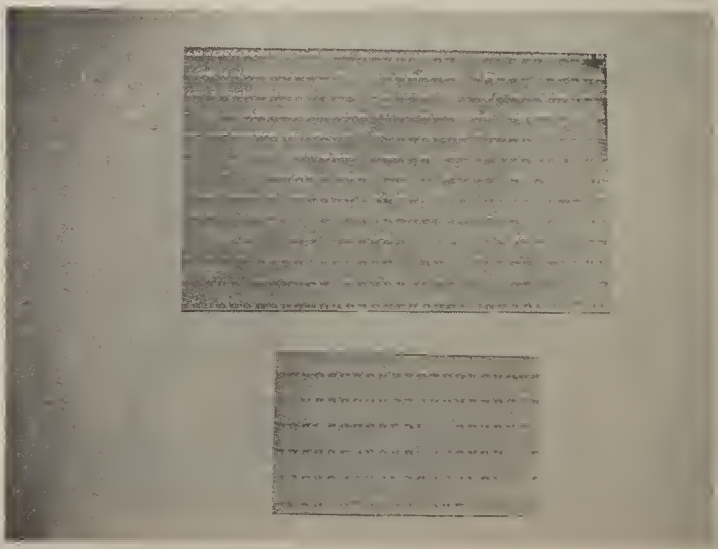
American Foundation for the Blind

Plastic Script Guide 3" x 5", WS-296 — $2.75
5" x 8", WS-297 — $2.75

Plastic grid with raised horizontal lines which serve as a guide for writing script. Paper is placed over the grid and the raised lines are felt through the paper.

Advantages: Not bulky. Card size.

Disadvantages: May be difficult for some people to feel the lines. May not provide enough structure for some.



QUESTIONNAIRE

In order to establish areas of concern and supplement our findings, we ask that you please complete this questionnaire.

1. What aids, appliances or specific areas do you feel need to be reviewed in future issues of AAR?

2. We are interested in learning about banking systems and services that are helpful to the visually impaired. Do you use or know of any other systems not discused in AAR issue No. 3?

3. We would like to compile a list of local distributors for aids and appliances. Where do you purchase aids locally?

4. We expect there are many handwriting guides or techniques which are not reviewed in this issue of AAR. Please inform us of any that you know of.

5. We are looking for good examples of the practical application of aids and appliances in specific situations such as craftsmen and their measuring devices or the use of unique marking and labeling systems of homemakers. These persons are a great source of information. Will you please list persons willing to be cited as examples?

6. Are you aware of any unusual devices, methods or techniques used to teach specific skills or to perform particular tasks that would be useful to share

Name: ____________________ Address: ____________________

Position: ____________________

Agency: ____________________

American Printing House for the Blind

Embossed Pencil Writing Paper #1-0456 — $4.10/pad

Regulation white braille paper embossed with heavy guidelines ¼″ apart is available for use in pen or pencil writing. The 10½″ x 8 ¾″ sheets are made up in pads of 165.

Advantage: No other guide is needed.

Disadvantage: The resulting product shows that a guideline was necessary.

American Printing House for the Blind

Bold-lined Writing Paper $1.60/pad

Paper ruled in bold lines with wide spacing to give visual guidance to low vision individuals. Four types available: Beginner's writing paper, green-lined paper for grade school pupils, notebook paper and letter writing paper. Letter writing paper comes in two styles: 1-0481 has lines 2/16″ apart, and 1-0482 has lines 9/16″ apart.

Advantages: No other guide is required. Wide spaces allow user to write larger than normal to better see what he is writing.

Disadvantages: Finished product shows that the guidelines were necessary.

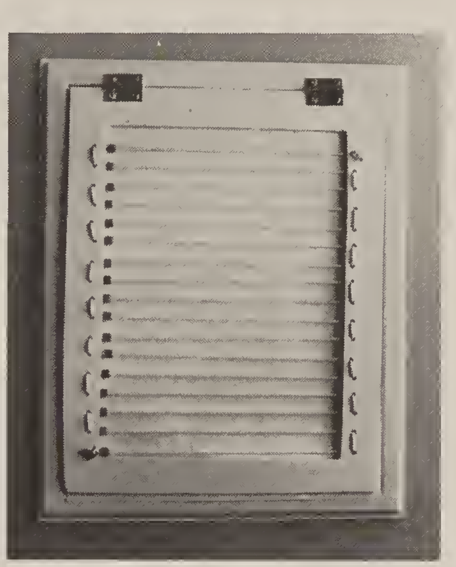
Arkansas Enterprises for the Blind

Arkansas String Board *with beads* — $5.50
without beads — $4.50

Top hinged frame strung with 18 horizontal nylon cords, providing ½″ writing space between cords. Cords are flexible and facilitate formation of letters descending below the line. Available with or without beads.

Advantages: Offers flexibility for writing descending letters. May also be used to address envelopes.

Disadvantages: Lines may be too flexible for some. Beads may not remain in place if guide is moved. Plastic board cracks easily. Board and cords are both white, providing little contrast for low vision persons.



Gloria Garrett

Garrett String Guide $3.00

Top hinged frame holds 8½″ x 11″ paper. Black elastic strings provide lines on which to write. Plastic beads mark place on line. Constructed of masonite.

Advantages: Relatively inexpensive. Offers flexibility for writing descending letters. People with low vision may be able to see contrast between black lines and white paper. May also be used to address envelopes.

Disadvantages: Lines may be too flexible for some. Beads may not remain in place if guide is moved.

Comment: Payment must accompany order.

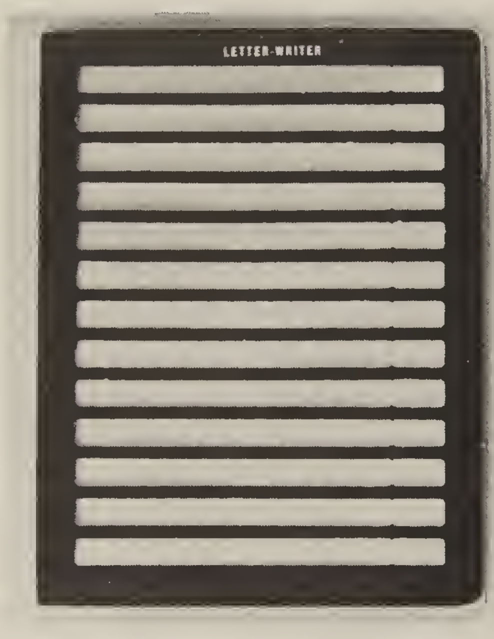
Hewitt Printing Corporation

Hewitt Letter Writer **$.60/set**

A folded page cardboard template with spaces cut for each line. An 8½″ x 11″ sheet of paper is inserted into the folded template. May be used with a clipboard or fastened to paper with paper clips. Available in bulk sets with envelope addresser, only. Minimum order, 10.

Advantages: Inexpensive. Good contrast. Not bulky.

Disadvantage: Cardboard is not durable.



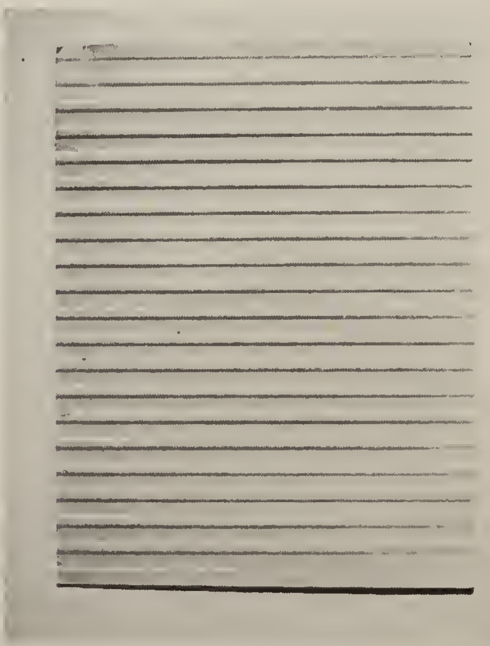
Howe Press

Grooved Fiber Writing Card **$3.85/doz.**

8½″ x 11″ medium weight cardboard with horizontal grooves and ridges running the width of the board. Paper is placed over the board and the individual tactually follows the grooves through the paper while writing.

Advantage: A good tactile writing guide for some.

Disadvantages: For many people it does not give enough tactile information when following the grooved lines. Rigidity of lines causes jerking of hand. Can cause irregularities of lower parts of letters.



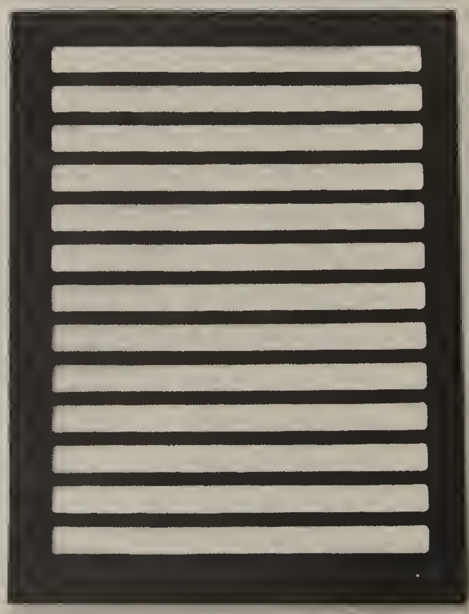
Independent Living Aids

Full-page Writing Guide **$3.95**

A full-page black plastic template with spaces cut out for each of the 13 lines.

Advantages: Durable. Good contrast. Not bulky.

Disadvantage: May warp or melt when exposed to sun or excessive heat.



Spartan Plastics

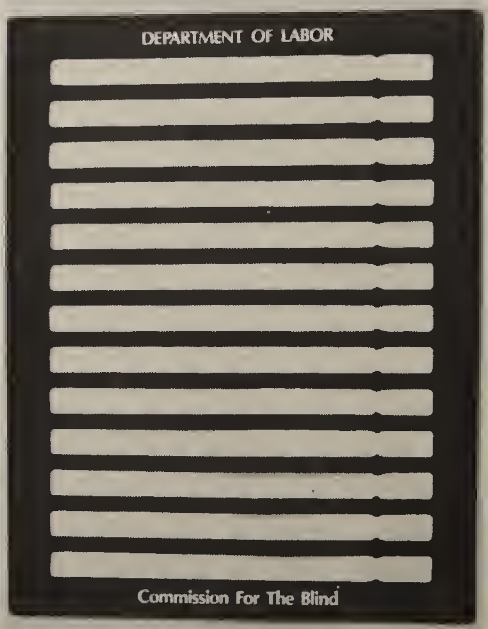
Plastic Letter Writing Guide **$1.80/set**

A full-page black plastic template with spaces cut out for each line, 13 in all.

Advantages: Good contrast. More durable than cardboard. Not bulky.

Disadvantages: May warp or melt with exposure to heat or sun.

Comments: Full-page guide comes with 3 signature guides. Available in bulk order only. Other colors and clear plastic are available.



Telephone Pioneers of America

Pioneers' Handwriting Guide

An inclined masonite clipboard design 9″ x 15″. Notches on the raised side boards for placement of metal rods. Allows for 20 lines of writing on a sheet of paper.

Advantages: Incline may be a more comfortable writing angle. Very durable. Paper held stationary by clip.

Disadvantages: Raised side boards may get in way of writing. Metal rods must be moved by user allowing for loss of place.

Comments: Initial models made by local Telephone Pioneers. Not now available from the Pioneers. Can be made by agencies or individuals who find it useful. Construction plans are available from Carroll Center for the Blind.

ENVELOPE ADDRESSING

The need for neatness and legibility when addressing an envelope is obvious. A letter or a check which is sent in an envelope on which the address cannot be discerned simply will not reach its destination. Addressing envelopes can pose special problems due to the standardized format required.

Envelope Addressing Techniques

Typing the information onto the envelope works well for those who can type and can determine the proper spacing. Full-page handwriting guides can be used by placing the envelope in the guide and then lining up the top three lines for the return address and the next three or four for that of the addressee. A technique which does not require a commercial guide is to fold the envelope in such a manner that the creases define the areas for the addressee and return address. Folding so as to define the center of the envelope may provide adequate guidance for some.

Another technique is to use the non-writing hand as a guide. By placing this hand on the center of an envelope, a person is able to use the middle three fingers as guides. The name of the addressee can be written just above the ring finger. Once that is completed, the ring finger can be folded under or moved upward to leave a space for writing the address. The city and state would then of course be written just above the index finger. This method can be used for a return address even though it will be large.

The writing of the return address can be difficult especially on an envelope that is smaller than the standard business size. Return address stamps and labels can be purchased from many mail order catalogs and provide an inexpensive, practical solution for this problem.

Please note that a new postal service regulation requires that the bottom ¾″ of the envelope be free of writing to increase postal efficiency.

Envelope Addressing Guides

There are only a few envelope addressing guides available commercially; they are generally of a template design with space cut for each line of information.

ENVELOPE-ADDRESSING RESOURCES

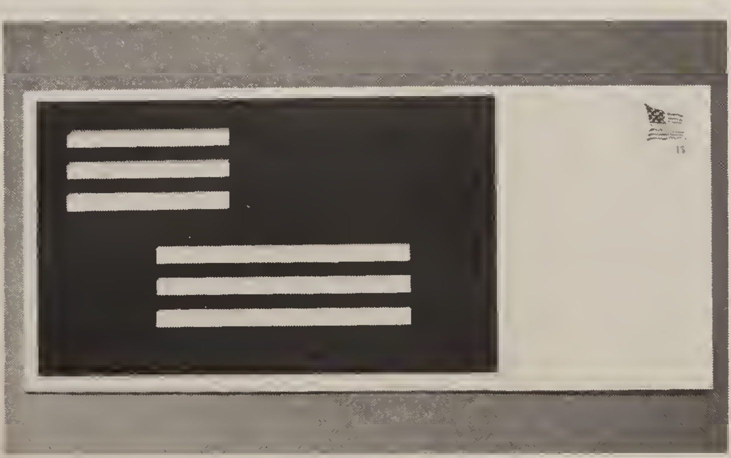
American Foundation for the Blind

Envelope Addressing Guide **WS-412 — $1.50**

Plastic template with cut-out lines to correspond with standard "address to" and "address from." 3¾″ x 6¼″.

Advantages: Inexpensive. High contrast. Durable.

Disadvantages: Can slip if not secured.



Hewitt Printing Corp.

Hewitt Envelope Addresser — $.60

A cardboard template with cut-outs corresponding to the standard envelope layout.

Advantages: Inexpensive. High contrast.

Disadvantages: Not durable. Can bend or tear with use.

Comments: Available in set with letter writer only. Minimum order 10.

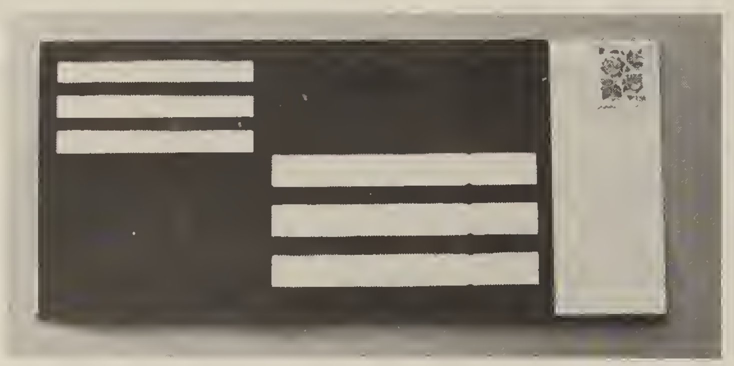
Independent Living Aids

Envelope Addressing Guide #291355 — $1.25

Plastic guide 4½″ x 7¾″ with cut-out lines to correspond with "address to" and "address from" areas.

Advantages: Durable. Inexpensive. High contrast.

Disadvantages: Can slip if not secured. May not work well on small envelopes or postcards.



CHECK WRITING

The ability to manage one's financial resources with minimal assistance is a very important facet of independence for the visually impaired individual. Many cases have been noted where a person works to become independent, maintains an apartment, and is employed, but has minimal control over his financial resources because concerned family members have set up all bank accounts jointly. A major reason for this has been the individual's inability to write checks and keep records independently. This is especially true for some congenitally blind who do not have a need for a checking account until they are living independently.

The need for an individual to write checks that are legible is of paramount importance. Privacy and independence are lost when others must be involved. Check writing guides enable visually impaired persons to write their own checks and complete other banking documents.

Techniques

The major technique used in check writing without the use of a guide is typing all the necessary information onto the check. This can easily be accomplished by a typist who is given some initial assistance by a sighted person. Each area of the check can be consistently located once the number of spaces and lines it takes to move from one place to the next has been memorized or recorded. Each individual would need to determine these lines and spaces for his own personal checks. Then only the signature need be written.

The American Printing House for the Blind has a raised line checkbook which supplies detailed instructions on how to fill out their checks using a typewriter. The typist must use the embossed lines as a guide to setting up the format on the typewriter. These instructions can give a person an idea of how this technique is accomplished.

Check Writing Guides

Check writing guides are produced commercially in a variety of materials and are available in a standard format or can be custom-made. As with the envelope guides, most are of a template or stencil design, with a space cut to correspond with each line on the check.

For the most part the commercially produced guides are sturdy and durable but the expense and time involved in ordering a guide may make it impractical for some people. Custom-made guides allow the person to use checks he may already have and allow for a larger selection of colors and styles. In ordering the custom-made guide the individual must send a blank, voided check to the guide manufacturer for use as a pattern. Standard commercial check guides are designed to be used with only one standard style of check and therefore may limit the colors and designs available.

Check writing guides, like signature guides, can also be made at home from many available items such as an old plastic placemat, a vinyl document cover, a manila file folder, or a piece of sturdy cardboard. The material chosen will determine the durability of the guide. A razor sharp knife works better than scissors for cutting out thin spaces.

Many of the signature guides are designed for easy alignment on checks allowing the user to write his signature in the proper area with no assistance. Signature guides are quite helpful in endorsing checks.

Raised line and large print checks, available from certain check-printing companies, can be ordered through the bank in the same manner as regular checks. At the present time, neither raised line nor large print checks are included in the options that are presented to the banking customer when checks are initially ordered. Consequently, the bank official who orders the checks for the customer may either be unaware of or neglect to tell the customer of their existence.

The Deluxe Check Printers Inc. in Chicago offers the Guideline Check System which consists of checks, a register sheet and deposit tickets printed in bold lines and large type for the visually impaired person. Pertinent information areas on the checks have been accented by an embossed line. The Guideline Check is available to any bank requesting this service. Contact your local bank as to its availability.

The Chemical Bank Checkwriter System uses a specially designed check guide which, when used with the checks that have the check stubs to the left of the check, allows the user to write out the check and keep a braille record of the check. The checkwriter is a template which has openings for braille cells in the left section which corresponds to the check stub. People can braille the check information on this stub. The template also has cut-outs over the check area for a person to properly write out his checks. Chemical Bank has offered to assist any bank that may wish to adopt this service. Individuals may ask their local bank to inquire about this service.

The Industrial Bank of Rhode Island and the Virginia National Bank also use a similar braille checkwriter system with braille statements.

CHECK WRITING GUIDE RESOURCES

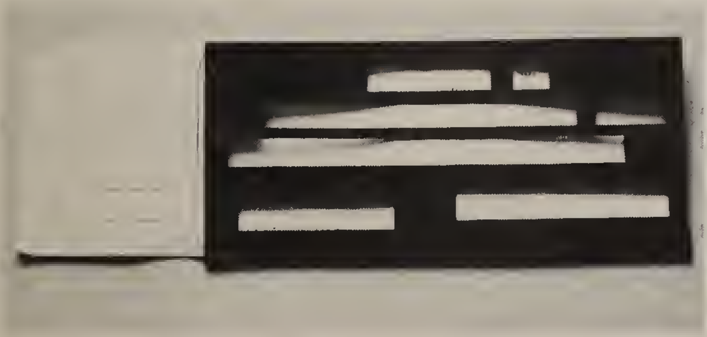
American Foundation for the Blind

Check Stencil **$3.95**

A plastic template for filling in necessary information on a check. A voided, blank, sample check must be submitted since each guide is made to order.

Advantages: Allows the user to have non-standard checks. All spaces correspond to lines on check. Easily carried.

Disadvantages: The plastic has been known to melt or warp if left in the sun for extended periods of time. Inaccuracies may occur.



American Printing House for the Blind

Raised Line Check **w/bank code — 50/$6.00**
w/o bank code — 50/$4.25

The raised line checkbook has raised, ink-print lines on regulation checkbook paper, interleaved with plain braille paper for stub record keeping. The cover is made of regular bankbook stock. The checks are perforated for easy detachment. There are 50 in each book. If checks are to be used for one's personal checking account, a blank check must be submitted so that the magnetic banking code on it may be copied. The system was designed for filling out checks on a typewriter. Typing instructions are given.

Advantages: Allows a totally blind person to write in check information independently.

Disadvantages: For many, lines are not raised enough to distinguish when filling out a check in script.

Chemical Bank

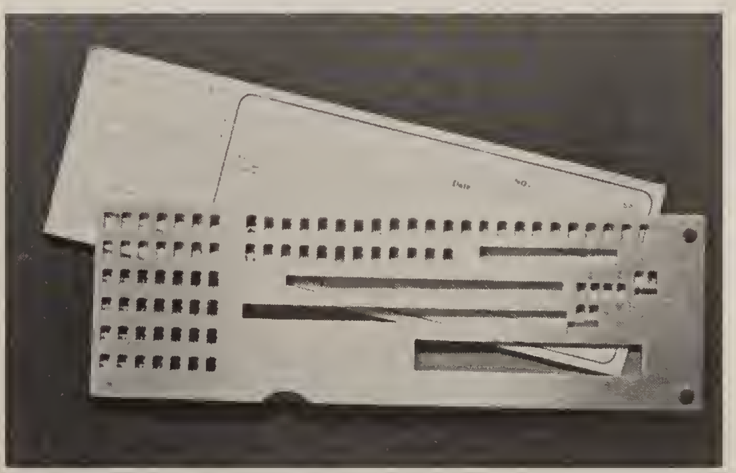
Braille Checkwriter **$2.65**

Device consists of riveted aluminum plates with guides corresponding to the blank lines on the check. Has braille cells that enable user to imprint the information needed to identify the check when it is returned from the bank. Braille cells are also used to keep records on check stub. Some banks provide to the legally blind as a free service.

Advantages: Allows braille user to keep records independently. The only system combining braille and script.

Disadvantages: Some spaces are small and difficult to write in. Only practical for users of braille.

Comment: Chemical Bank may be able to supply the checkwriter to some individuals at a cost of $2.65.



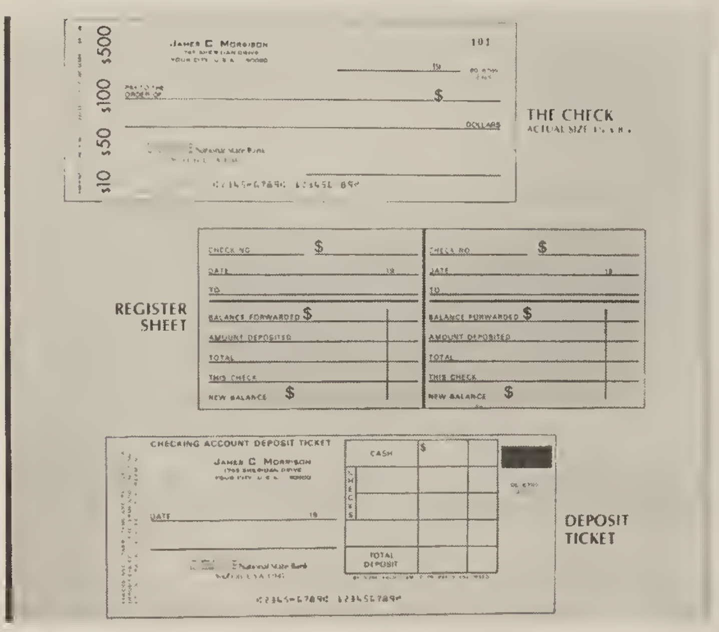
Deluxe Check Printer, Inc.

Guideline Checkbook

A checkbook printed in bold lines and large print for people with impaired vision. Includes deposit tickets, register sheet, and personalized checks with magnetic bank code. Embossed lines on check indicate areas of pertinent information. Available through local banks. Inquire at yours.

Advantages: Allows low vision users independence in checkbook banking. Easy access to records.

Disadvantages: Does not supply account statements in large print. Embossed lines cannot be used without vision.


$10 $50 $100 $500
JAMES C. MORRISON
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CASH
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DEPOSIT TICKET

Hewitt Printing Corporation

Hewitt Check Writer **$.15 ea. (minimum of 10)**

Cardboard template for filling in necessary information on checks.

Advantages: Inexpensive. Black cardboard creates good contrast for persons with low vision.

Disadvantages: Cardboard has limited life and durability. Spaces may not conform to lines on all check formats.

762
CHECK-WRITER
Newton-Waltham
HEWITT PRINTING CORP.
Telephone: (312) 847-8833
7320 N. Milwaukee Chicago, Ill. 60648

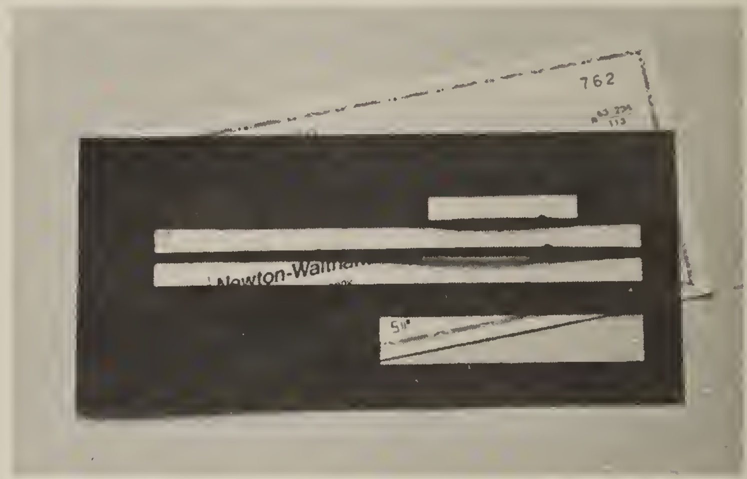
Independent Living Aids

Check Writing Guide **#163733 — $3.50**

A template for filling in necessary information on a standard 2¾″ x 6″ check.

Advantages: Durable. Aligns well with a standard check. Good contrast.

Disadvantages: May slip while in use if not secured.



Betty Jo Keitzer Check Writing Guide

Keitzer Check Writing Guide **$7.00**

Black plastic guide and base plated with spaces cut for date, payee, amount and signature.

Advantages: Very durable. Provides much structure for those needing it. Black creates good contrast for low vision users. Readily available.

Disadvantages: Expensive, standard type check must be used. Not flexible to allow for descending letters.

Comments: Works best with checks that have end stubs or if check is removed from checkbook.

HOMEMADE TEMPLATE GUIDES

Most of the handwriting guides that use the template format can be made at home by a person who has some vision and who is able to cut the proper sized openings in the various materials used. Friends and family members who know the proper techniques usually will have little trouble making the guides.

The advantage of the homemade guide is that the person is able to have the guide made quickly for his own particular needs. There is no dependency on a commercial vendor, no waiting time and no limitation to specific types of formats. A homemade template guide can be made to fit over one's own signature and can even be designed to fit in the proper location on documents that are repeatedly signed. A guide can be designed for an individual's checks, deposit slips, envelopes, writing paper or business forms. Task guides can be designed for use on the job to allow a worker to fill in the proper information on forms. Recently, a client at the Carroll Center designed and had made his own postcard guide. The type of guide to be made is limited only by one's own needs.

The homemade guide can be fashioned from a variety of materials, depending on the maker's skills and resources. Aluminum and Plexiglas guides are among the most difficult but are the most durable. The homemade guide is usually made out of a readily available material which would be easy to cut out. File folders, document covers, acetate sheets, rubber mats and vinyl placemats are examples of materials that are useful. The material that is used with the most success at the Carroll Center is exposed X-ray sheets. These sheets are sometimes available through local hospitals. A commercial product which is somewhat similar is acetate sheets. These large, clear sheets can be purchased at stationery stores and art supply stores. There are permanent marking pens which will satisfactorily write on acetate sheets, thereby allowing a person to color the guide to add contrast.

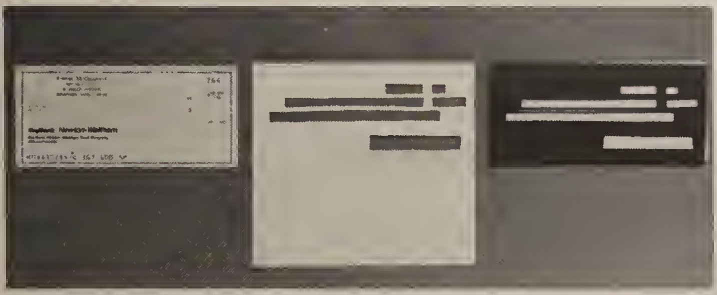
The following description is intended to give the reader a general approach to making homemade handwriting guides. We will use the example of a check guide, but the procedure is the same for most guides. In making a homemade check template guide, the following materials will be needed: a copy of the check, a piece of paper, pen or pencil, a plastic sheet of X-ray film or acetate, a single-edge razor-knife, a metal rule and a marker that will write on acetate.

The first step is to decide how the template guide will fit over the check. The method which is effective for most types of checkbooks, although not all, is to have the check fit into a guide, consisting of template and backing cut out of one piece and folded at the bottom. A flatter guide can be made by using two pieces of material taped together at the bottom. This guide would then be the same size as the check. The template, of course, would be on the front side. Once the proper format is established, it is best to make a paper template first. Cut a piece of paper as wide as the check and twice the height. Fold the paper in half and place the check into the folded paper with the fold on the bottom. Now trace the appropriate openings onto the paper. In tracing these openings remember that the horizontal areas between the openings will be the part of the template which will be the guide. The wider this area can be, without restricting the writing area, the more durable the guide. Therefore, on most checks, the opening for "Payable to" may need to be a little higher up than the line that is drawn on the check. This will still work effectively.

When the paper template has been traced, the openings can be cut out. This template is then used to make the final guide. Cut the plastic sheet to the size of the paper. Lay the paper template on top of the plastic sheet and attach it with tape or paper clips. The opening can now be drawn on the plastic sheet with an appropriate marker or scratched in with a pin. It may be easier to partially fold the guide now while the upper section still has strength. You can continue your work with the folded portion of the guide over the edge of the table. The paper template can be removed with the razor-knife, and with a metal rule as a guide you can cut the openings. When using the knife it is best to cut it through in two or three easy passes rather than to use a lot of pressure to make it through in one cut. With greater pressure it is easier to overcut and ruin the guide. When the openings have been made, the guide can be folded and you can rub the metal rule over the fold to improve the crease. Place the check in the guide to make sure that the openings are properly aligned. The acetate guide may need to have the outline of the openings darkened with a marker if the guide is to be used by someone with low vision. The guide should now be ready for use.

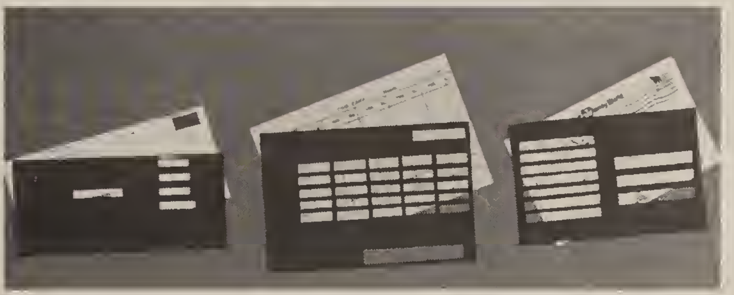
As has been stated, this procedure could be applied to the making of any homemade handwriting guide.

Steps to Homemade Check Guide



Check *Paper Template* *Check Guide*

Examples of Homemade Guides



Deposit Ticket *Time Card* *Post Card*

BIBLIOGRAPHY ON HANDWRITING

The following bibliography is of literature which pertains to handwriting for the visually impaired. Within the literature there is some mention of the uses of handwriting guides and there are a few articles on the guides themselves. The majority of the information, however, is concerned with teaching the techniques of scriptwriting to the blind student.

This bibliography was compiled from the resources at the Samuel P. Hayes Research Library at the Perkins School for the Blind, Watertown, Massachusetts.

American Foundation for the Blind. *Products for People with Vision Problems.* 25th Anniversary Edition, 1979.

Anderson, Delores. "A Simple Writing Guide for Blind Students." *Journal of Visual Impairment and Blindness.* 72:1, October 1978, p. 325.

Barr, Ruth L. "Embossing Arabic Letters and Numbers on New Raised-Line Polyethylene Paper: an Aid for the Blind." *Science* 169, July 1970, p. 94-95.

Barr, Ruth L. "New Technique Helps Blind Write." *The Seer,* 43:1, Spring, 1972, pp. 13-16. (same article as above.)

Buell, John A. "Situation Signature: A Case Study." *Rehabilitation Teacher,* 6:6, June 1974, pp. 9-13.

Edgar, W. *Teacher of the Blind,* 36, February 1936, p. 120.

Eggleston, Leslie. *The Teaching of Pencil Writing.* Reprint from Monograph #2, The New York Institute for the Education of the Blind.

Emblem, J.R. *New Beacon,*April 15, 1983, p. 101.

Freund, Elisabeth C. "Screen Pads for Longhand Writing." *New Outlook for the Blind,* May 1968, pp. 144-147.

Freund, Elisabeth C. and Nagano, Paul. *Longhand Writing for the Blind, Based on the Marks Method.* Overbrook School for the Blind, 1966. Louisville: American Printing House for the Blind, 1966.

Guldbergs, C.E. *Schreibapparat Fur Blinde (zur bleifederschrift.)* n.d., 8 pp.

Harrison, Letha Mae. "Scriptwriting for the Blind: A Status Survey and A New Method." A thesis submitted in partial fulfillment of the requirements for the degree of Master of Arts. Colorado State College, Greeley, Colorado, Summer 1968. 33 pp.

Heimers, Wilhelm. *Einfuhrung in die deutsch Blindenkurzschridt,* Hanover-Kirchrode n.d. 60 pp. (On the learning of point (braille) and pencil writing.)

Huckins, A.P. "Teaching Handwriting to the Blind Student.": *New Outlook for the Blind,* 59, 1965, pp. 63-65.

Illinois Dept. of Children and Family Services, Community Services for the Visually Handicapped. *Handwriting Manual. A Reference Manual for Rehabilitation Teachers Working with the Adult Blind.* Kalamazoo: Western Michigan University, 1971.

Johnson, Susanne. "Factors Influencing the Acceptance by Rehabilitation Clients of Instruction in Scriptwriting and Typewriting." *New Outlook for the Blind,* 64:9, November 1970, pp. 281-284.

Keitzer, John E. and Keitzer, Betty Jo. Checkwriting Guide. U.S. Patent #4,003,143. Jan. 18, 1977. 3 pp.

Kortz, Lucy. My *Personal Experiences with the Outside World: Hands are to the Blind as the Sun is to the Day.* Typed, 23 pp. (Topic 8 is on teaching a blind person manuscript writing.) Boston College Teacher Training Class papers, 1966-1967.

Marks, Anna S. and Robert A. *Teaching the Blind Scriptwriting by the Marks Method,* a Manual. New York: American Foundation for the Blind, 1954.

Stark, Mary Lou. "Restoration and Habilitation of Handwriting Skills to Adults in a Rehabilitation Center Setting." *New Outlook for the Blind* 64:10 December 1970, pp. 330-339.

Stocker, C. "A New Approach to Teaching Handwriting to the Blind." *New Outlook for the Blind* 57, 1963. pp. 208-210.

Takemoto, Y. "Scriptwriting Training at Ho'Opono." *New Outlook for the Blind,* 58, 1964, pp. 61-62.

Taylor, Reginald D. "A Tactile Device for the Blind" from *Devices and Systems for the Disabled Conference,* Kwataya and S. Zuckerman, Eds., Philadelphia 1975.

Toorn, Aa. J. van der. "Pen-in New Writing Aid for the Blind." Proceedings of the Congress: Coordinated European Efforts for the Third World, held in Vierhouten, Netherlands, Oct. 7-10, 1975, pp. 45-56.

Weiss, Johnette and Weiss, Jeff. "Teaching Handwriting to the Congenitally Blind." *Journal of Visual Impairment and Blindness,* 72:2, Sept. 1978, pp. 280-283.

Wheeler, Jane G. "Teaching the Concept of the Diagonal During Handwriting Lessons for the Congenitally Blind." *New Outlook for the Blind,* 64:8, October, 1970, pp. 249-255.

Woodworth, Marion. *New Beacon,* February 15 1939, p. 35.

RESOURCE ADDRESSES

American Foundation for the Blind
15 West 16th Street
New York, N.Y. 10011

American Printing House for the Blind
1839 Frankfort Avenue
P.O. Box 6085
Louisville, Kentucky 40206

Arkansas Enterprises for the Blind
2811 Fair Park Blvd.
Little Rock, Arkansas 72204

Chemical Bank
Consumer Affairs
20 Pine Street
New York, N.Y. 10003

Deluxe Check Printers, Inc.
3456 North Kedzie Avenue
Chicago, Illinois 60618

Designs for Vision
120 East 23rd Street
New York, N.Y. 10010

Dialogue Publications, Inc.
3100 Oak Park Avenue
Berwyn, Illinois 60402

Mrs. Gloria Garrett
3202 Dalewood Road
Oxon Hill, Maryland 20022

Hewitt Printing Corp.
7320 Milwaukee Avenue
Niles, Illinois 60648

Howe Press of Perkins School for the Blind
175 North Beacon Street
Watertown, MA 02172

Independent Living Aids
11 Commercial Court
Plainview, N.Y. 11803

Mrs. Betty Jo Keitzer
1129 Peninsula Drive
Lake Wales, Florida 33853

Massachusetts Association for the Blind
200 Ivy Street
Brookline, MA 02146

Spartan Plastics
P.O. Box 67
Holt, Michigan 48842

Sped Publications
2010 Eagle View
Colorado Springs, Colorado 80909

PROBLEM CORNER

While researching check guides for this issue of Aids and Appliances Review, we were reminded of the need for effective, independent banking services and systems that can be utilized by visually impaired persons. The process of independent banking transactions encompasses a great deal more information than the checkwriting techniques discussed in this issue of AAR.

As indicated within this Review, The Chemical Bank of New York, Industrial Bank of Rhode Island and The Virginia National Bank all offer braille checking accounts which use a braille checkwriter and provide braille account statements. The Chemical Bank has offered to assist any bank that wishes to adopt this service. Individuals may ask their local bank to inquire about this service.

The Deluxe Check Printers, Inc., in Chicago, offer a large print checkbook system to any bank. This will ease the handling of financial transactions by some visually impaired persons, although it does not include large print account statements.

These systems represent some of the ways that visually impaired individuals can be assisted. Some banks provide account statements on cassette tapes or in braille, but this is usually an individualized service.

We would like to learn of any other systems that are available, as well as any banks that offer the braille banking services. Information or suggestions concerning techniques, methods or organization, record keeping, filling out deposit slips and registers, as well as methods of reviewing this information, would be appreciated. We are also interested in techniques that make account statements accessible to the visually impaired. We hope to be able to share this information in future issues of *AAR*.

NEWS FROM THE FIELD

Independent Living Aids, Inc. is a newly formed organization whose aim is to offer an alternative to visually impaired persons and the agencies devoted to serving them in their selection of aids and appliances. ILA became fully operational in January 1980, offering a wide variety of daily living aids. Their product listing includes such items as watches, canes, kitchen products, household, personal and recreational products, writing and communication aids, sewing devices, medical devices, tools and instruments. A catalog is currently available with a complete listing of their products and prices.

Independent Living Aids, Inc. is located at 11 Commercial Court, Plainville, N.Y. 11803.

The American Foundation for the Blind has recently released the 25th Anniversary edition of their catalog, "Products for People with Vision Problems." It is published in large type and in braille with product descriptions explaining the purpose of each aid, its appearance and features. Hints on use and limitations of the products are also included where applicable. The products listed cover the wide variety of items that AFB has supplied over the years as well as many new products.

A new section on Low Vision Products has been included along with other services and resources. "Products for People with Vision Problems" is published by the American Foundation for the Blind, Consumer Products Department, 15 West 16th Street, New York, N.Y. 10011, and is free of charge.

The Carroll Center for the Blind gratefully acknowledges a grant from the Cowan Foundation which has made this publication possible.

AIDS AND APPLIANCES REVIEW

THE CARROLL CENTER FOR THE BLIND
770 Centre Street, Newton, MA 02158
(617)969-6200

December, 1980
Issue No. 4
Editor: Robert McGillivray

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INTRODUCTION

The topic of this fourth issue of *Aids and Appliances Review* is Speech Compression. Research and development of time-compressed recorded speech have been going on for many years but it is only recently that speech compressors for personal use have been commercially available. Speech compressors now allow a person to listen to tapes or records with greater speed and hopefully greater efficiency. This can be a great advantage for those who depend on tapes or records as their primary method of reading.

The following review is a collaboration by persons who have expertise in the field of speech compression and we are very grateful for their contributions.

Emerson Foulke, Ph.D., Director of the Graduate School of Perceptual Alternative Laboratory at the University of Louisville, is a pioneer in the field of time-compressed recorded speech and contributed to this issue of AAR by writing the section on the history of various methods and techniques used to produce compressed speech.

Leonard Mowinski and Harvey Lauer are Blind Rehabilitation Research Specialists at the Hines Blind Center Research Department at the Veterans Administration Hospital in Hines, Illinois. They have kindly expanded and updated their article, "Personal Type Speech Compressors," which originally appeared in *Braille Forum*, Vol. XVIII, No. 9.

Harvey Lauer has also written an article from the point of view of a consumer, teacher and researcher in communication aids for the blind.

Hadi Madjid, Ph.D., is a consumer who has conducted an investigation of commercial speech compression methods to determine the unit which would best fit his own needs. He has assembled information that he has observed as to the quality of those units he evaluated.

Following these articles is an abridged bibliography of the literature which pertains to speech compression as it relates to the visually impaired population.

READING BY LISTENING TO TIME-COMPRESSED RECORDED SPEECH

by
Emerson Foulke, Ph.D.

Time-compressed, recorded speech is speech which is reproduced in less time than the time required for its original production. When recorded speech is compressed in time, its word rate is increased. If an oral reader requires one minute to read a paragraph containing 175 words, and if a tape on which his reading has been recorded is reproduced in one half minute, the word rate of the reproduction will be 350 words per minute, and the recorded speech will be compressed in time to 50% of its original production time.

There are several methods for compressing speech. The simplest is the speed changing method, a method familiar to most Talking Book readers. If a record, or tape, is played at a faster speed than the speed at which it was recorded, the speed recorded on the record, or tape, will be compressed in time, and its word rate will be increased. However, when speech is compressed in this manner, the pitch of the speaker's voice is raised, and his voice quality is distorted. When speech is compressed too much by this method, it becomes unintelligible. Many listeners would have great difficulty understanding speech compressed to one-half of its original production time by playing at 7½ inches per second a tape recorded at 3¾ inches per second; or by playing at 33 1/3 revolutions per minute a record recorded at 16 2/3 revolutions per minute. However, some useful compression in time is possible with this method. It is a question of balancing the increase in word rate against the distortion in vocal pitch and quality. A moderate distortion of this sort should not interfere seriously with intelligibility, but, when such speech is listened to for a long period of time, the result may be an unsatisfying listening experience, and there is the possibility that the reader's dissastifaction may color his interpretation of what he has heard. On the other hand, a student who has a great deal of reading to do in a limited amount of time may be willing to tolerate considerable distortion in order to increase the rate at which he reads by listening.

Another method is now available that makes possible the compression of recorded speech without distortion in vocal pitch or quality. It is called the sampling method. In this method, not all of the original recording is reproduced. Instead, brief samples of the original recording are periodically discarded, the resulting gaps are closed, and the remaining samples are reproduced at the speed used during recording. The duration of discarded samples is so short that the ear cannot detect their absence and is shorter than even the shortest speech sounds. Thus, no speech sound can ever be entirely discarded. To illustrate, imagine that a tape, containing speech recorded at 15 inches per second, has been cut into half-inch segments, and these segments have been numbered consecutively. Now, if all of the even-numbered segments are thrown away, and the odd-numbered segments are joined together again, the resulting tape will be only half as long as the original tape, and, if it is reproduced at the recording speed of 15 inches per second, only half as much time will be needed to play it. The pitch and quality of the speaker's voice will be preserved, but the rate at which words occur will be doubled. Each of the discarded segments of tape will contain 1/30th of a second, or 33 milliseconds of the original recording. When discarded samples are only 33 milliseconds long, their absence will not be noticed by the listener. All he will notice is an increase in the speaker's word rate. You can demonstrate this approach for yourself, if you have the patience. As a matter of fact, the success of the sampling method was first demonstrated in just this way, in 1953, by Dr. William Garvey. However, the required tape splicing is so tedious and time consuming that, if no other way could be found to sample recorded tapes, the sampling method would have no practical value.

Fortunately, another way was found. In 1954, Dr. Grant Fairbanks and his coworkers at the University of Illinois demonstrated a successful, electromechanical speech compressor. A compressor of the Fairbanks type is a tape reproducer, not a tape recorder. When a tape is played on it, the compressor reproduces samples of the original recording, and these samples are abutted in time to produce time-compressed or accelerated speech that is not distorted in vocal pitch or quality. Sampling is accomplished by a sampling wheel containing four tape playback heads, equally spaced around its curved surface. When a tape is played on this compressor, it is pulled over the curved surface of the sampling wheel, and it is wrapped around the sampling wheel just enough to make contact with one fourth of its curved surface. The sampling wheel is driven by a motor, and, as the tape is pulled across it, it is made to revolve in the direction of tape motion. Because, under these conditions, each playback head, in its turn, makes brief contact with the moving tape, each playback head reproduces a brief sample of the speech recorded on the tape. It is these samples that are heard as compressed speech. Short segments of the tape being reproduced are never touched by a playback head. The speech samples recorded on these segments are therefore not reproduced, and so they are the samples that are discarded.

Recorded speech may also be expanded in time with a resulting reduction in word rate. In the case of the speed-changing method, this is accomplished by playing a tape or record at a slower speed than the speed at which it was recorded. In the case of the sampling method, it is accomplished by repeating speech samples periodically instead of discarding them periodically.

A computer may be used to compress or expand speech in time by the sampling method. To accomplish this, the output of a tape player or record player is connected to a device called an analog-to-digital converter, the function of which is to digitize the recorded speech signal. A digital representation of the recorded speech signal is stored in computer memory where it can be sampled by the computer. As in the case of the electromechanical sampling earlier, some samples are discarded and the remaining samples are abutted in time. The compressed speech signal, consisting of digitized samples of the original speech signal, is fed to a device called a digital-to-analog converter, the function of which is to convert the digitized speech signal to an analog speech signal again for reproduction as audible speech that is compressed or expanded in time.

Compression by the electromechanical method is not selective in regard to the samples that are discarded. The recorded speech signal is sampled periodically, and those segments of the recorded speech signal not included in the samples retained for compressed reproduction are discarded regardless of their content. The computer may be used to compress speech in the same way. However, it can also be selective in choosing the samples to be discarded. The reason for wanting to do this is that some speech sounds are of relatively long duration, and large portions of these sounds could be thrown away without destroying their intelligibility. On the other hand, some speech sounds are quite brief, and it might be better to leave these speech sounds completely intact by excluding them for the sampling process.

Although there has been a dramatic reduction in the cost of computers, a computer would still be a rather expensive speech compressor. However, the processes carried out by the computer can also be carried out by electronic devices designed specifically for that purpose. With the introduction of transistors, and more recently of integrated circuit chips, it has become feasible to make electronic speech compressors that are relatively inexpensive and small enough in size to be built into any conventional cassette recorder or record player. Several satisfactory speech compressors are now commercially available. Although they are much less expensive than the old electromechanical compressors (currently available compressors range in price from $150 to $600), they still cost enough so that many who might find them useful will be reluctant to buy them. However, if there is enough consumer demand for speech compressors, prices will fall enough so that anyone who can afford a cassette recorder can also afford a cassette recorder that includes speech compression as one of its functions.

PERSONAL TYPE SPEECH COMPRESSORS INFORMATION FOR TEACHERS AND CONSUMERS

By: Leonard Mowinski — Harvey Lauer
Hines V.A. Hospital, Hines, Illinois

This article presents an overview of the different speech compressors available for the blind and visually handicapped. This information has been derived from our experience in evaluating speech compressors, the companies' marketing literature, as well as the veteran population.

INTRODUCTION

There are four methods a blind person may use to read printed material. These include braille books and magazines, tape and disc recordings, a direct translation reading aid (Optacon, Sterotoner), and the sighted reader.

While none of these methods by themselves serve as an ideal means by which to read, collectively they do fulfill most reading needs. Some of the drawbacks are evident.

1. Not everyone knows the braille code. Learning braille can be time consuming and reading speeds may be slow.
2. Not only is there a time delay in receiving braille books, but not all books are translated into braille.
3. The Optacon is an expensive reading machine that most individuals cannot afford. It, too, involves learning a code. The Optacon does give the reader immediate access to print, but reading speeds are low and using the Optacon to read large amounts of material is not considered practical.

For most people the reading of tapes or discs is the fastest method of reading (150-175 words per minute) and does not require the learning of codes or new skills. But even this method has its shortcomings.

1. It takes a blind person longer to read printed material than it does his sighted counterpart.
2. The reader does not have an active part in the reading process.
3. The reader has no control over the rate at which the tape is being presented.

In contrast, the average sighted reader reading silently can cover from 300-500 words per minute. The ability to speed up the tape recordings in excess of 300 words per minute and listen at a faster rate would save time as well as eliminate inattention, boredom, and frustration.

For years people have tried to speed up recordings, with the result being a distorted speech sounding like "Donald Duck." This distortion can be tolerated at 1.5 times normal speed, but for most people it becomes unintelligible at speeds greater than that. Speech compressors have given us the ability to increase the speed of tapes up to 3 times normal speeds with the result being less total time spent reading while processing the information at least as well as by normal rate recordings.

Like a doctor's prescription, the speech compressor is a combination of ingredients; the two most important are the variable speed control option and the pitch corrector. The variable speed control allows the user to speed up the tape, the pitch corrector takes the distortion out of the tape once it is speeded up. There are two systems available that produce compressed or expanded recordings: the cassette deck which employs a variable speed control and pitch corrector built into one unit (examples are the Varispeech II, A7 speech controller and the TCS recorder from Science for the Blind); and the modular system which consists of a pitch corrector that is mated to those cassette players and phonographs that are equipped with a variable speed control option.

As of Fall 1980, there are several speech compressors, variable speed tape recorders and pitch correctors available. The Varispeech II by Lexicon, Inc., the A.P.H. recorder with speech control module from the American Printing House for the Blind, the recorders from Science for the Blind, the A7 Speech Controller by the Variable Speech Control Co., and the AmBiChron Pitch Shifter developed by Mr. Richard Koch and sold by Science for the Blind.

SPEECH COMPRESSORS

Some typical features of speech compressors are 1) they are A.C. powered, 2) they make uncompressed recordings, 3) they have complex electronic processors (pitch correctors), and 4) they will expand or compress in the playback mode with the result that their pitch and voice quality will sound normal regardless of the playback speed. They compress up to three times normal speed enabling people with ten hours of practice to read up to 400 words per minute. Listed below is a description of the available units. It is recommended that, when using any speech compressor, a headset or earphone be tried to obtain optimum listening speed.

Varispeech II - LOC (Lexicon) *NOTE: Production discontinued.*

The Varispeech II measures 5.5×9×13.5 inches long and weighs 12.5 lbs. The playback speed is .5 to 2.5 times normal speed with pitch correction and is continuously adjustable. The machine operates off of AC power only. Varispeech II recorders can be ordered with the Library of Congress option. This permits the user to not only play conventional 1⅞ mono cassettes but the four-track 15/16 mono cassettes as well. It only records in the two-track format. When ordering for a blind person, specify LOC; otherwise the machine will only play 2-track cassettes. Other features of the deck are pause control, automatic shutoff and automatic level control for taping. Tape and print instructions are included. The price of the Varispeech II minus the accessories is $595.00.

A7 Speech Controller-Variable Speech Control Co. (VSC) (Formerly the Cambridge Research and Development Group.)

This second speech compressor measures 7×3×10½ inches long and weighs 4 lbs. The playback speed is .6 to 2.5 times normal speed with pitch correction and is continuously adjustable. The recorder can be powered from an AC outlet or on 12-volt external DC. The machine is built for two-track standard cassettes at 1⅞ i.p.s. Other features are cue and review, pause control and automatic shutoff. Accessories include carry case, $21.95, DC 12-volt adapter for car or boat, $4.25, table mounting kit, $3.40 and a 12-volt transformer for international users, $8.50. Also available from VSC is the model AV1. This is a table top unit that incorporates a Wollensak tape recorder and VSC speech compression circuitry. The price of this unit is $366.62. The purchase price of the A7 is $258.12.

TCS Cassette Recorder

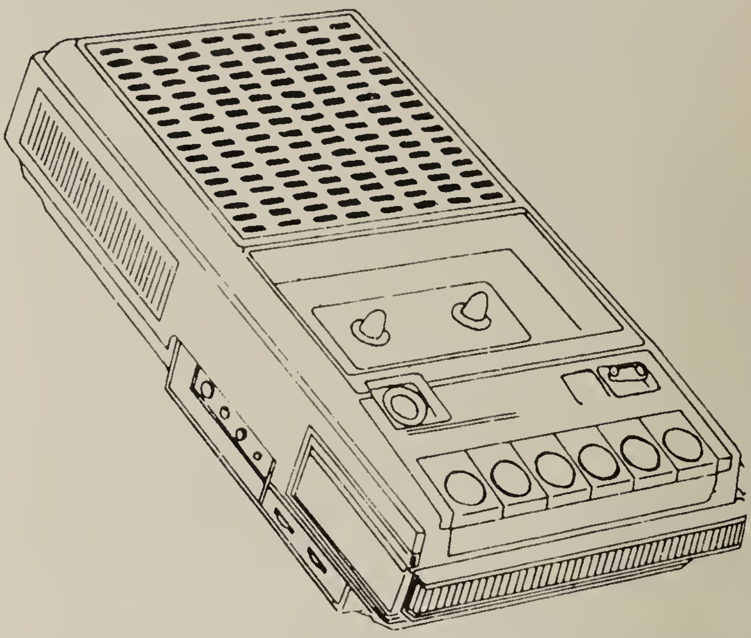
The TCS cassette recorder measures 3×7¼×9½ inches long and weighs 4.25 lbs. The playback speed is up to 2 times normal speed with pitch correction and expansion at 80% of normal speed without pitch correction. S.F.B. has two speech compressors available, one model is built for two-track standard cassettes with playback at 1⅞ i.p.s. and the second model will record and playback in the two and four-track modes. Controls include cue, review and pause. Accessories include shoulder and hand strap, auto adapter for plugging into a cigarette lighter, and a carry case.

The recorder utilizes 6 "C" cell batteries for DC operations or a rechargeable system in which the electronic circuity is modified to include 10 nickel cadmium AA cells that are rechargeable through the line cord for up to 4 hours of operation between charges. The rechargeable battery system is optional and the price is $40.00. The 2-track model (VIIA) sells for $275.00 and the 4-track model (VIIB) sells for $375.00.

VARIABLE SPEED RECORDERS

Unlike the speech compressors previously discussed in this paper, the following recorders do not have built-in pitch correctors for speech compression and expansion. An external pitch corrector would have to be used.

General Electric 5105 (Science for the Blind)



This cassette recorder measures 3×5×10 inches long and weighs 3¾ lbs. This is an economy recorder used for noncritical applications. It has been modified to play 4-track Library of Congress cassette tape; however, it records 2-track only. The variable speed ranges from half speed 15/16 i.p.s. to 2.5 i.p.s. The unit operates off [AC] power or 5 "C" cell batteries. For $25.00 a rechargeable battery system can be incorporated. The two units available include the V12V which is 4-track and variable speed. The price is $85.00. The second model, V12/2 is 4-track with 2 speeds, 15/16 i.p.s. and 1⅞ i.p.s. for $85.00.

Craig J - 103 Slimline (Science for the Blind)

This new product from S.F.B. measures 1¼×4½×7½ inches long. It has 4-track play and record. Features include cue and review, automatic stop and built-in microphone. Nickel cadmium batteries and AC adapter are included. You can purchase the recorder unaltered for $90.00. Model V-6B includes the above features with variable speed and sells for $180.00. The model V-6C is the 2-speed version 15/16 i.p.s. and sells for $180.00.

Craig 2629 (Science for the Blind)

This unit measures 2×4½×7 inches long and weighs 2 lbs. It has been modified to play and record 4-track recordings. Model V-7B with variable speed is $155.00 and V-7C with 2 speeds 15/16, and 1⅞ i.p.s., is also $155.00.

APH Player/Recorder American Printing House for the Blind (APH)

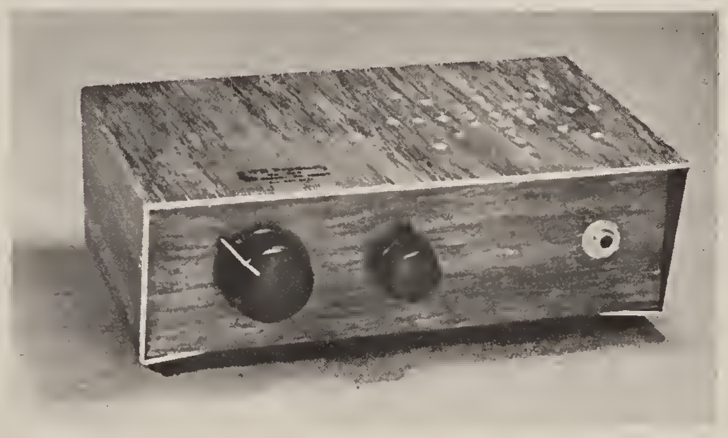
The recorder measures 3×9×10 inches long and weighs approximately 5 pounds. The playback speed is 80% to 1.5 times normal speed with pitch correction and is continuously adjustable. The machine can play and record two and four-track cassette tapes. Feature include two speeds 15/16 and 1⅞ i.p.s., pause control, automatic shutoff, and tone indexing. The price of the recorder/player is $155.00.

PITCH CORRECTORS

LOC-1 Speed Listening Adapter (VSC)

As of December 1979, VSC introduced the model LOC-1 speed listening adapter. The VSC adapter (pitch corrector) was designed to be compatible with the Library of Congress C-76, C-77 or later model cassette recorders. The unit measures 4×6×2½ inches high and weighs 11 ounces. The pitch can be corrected up to 2.5 times original speed and is continuously adjustable. The LOC-1 is $95.00. Braille and print instructions are available.

AmBiChron Model 144 (Science for the Blind)



Mr. Richard Koch, developer and inventor of the AmBiChron Pitch Shifter, has announced the introduction of the AmBiChron Model 144 available from Science for the Blind. It should be noted that AmBiChron Models 101 and 102 are no longer available. Model 144 measures 2×4×6 inches long. It is equipped with its own power amplifier and loudspeaker. It features volume and pitch controls, earphone jack and on-off switch. This unit operates on rechargeable battery or AC adapter. The Model 144 can be plugged into any variable speed or double speed playback machine to produce compressed or expanded speech. The playback speed is 30% to greater than 2 times normal speed and is continuously adjustable. This unit can be mated to the L.O.C. players, the APH recorder, the Craig 2629 or J-103 recorders and the G.E. 5105 from S.F.B. The price of this pitch corrector is $198.00.

APH Variable Speech Control Module (APH)

The APH Player/Recorder does not include a built-in pitch corrector. APH offers a unit they call the variable speech control module (VSC). The VSC can be mated to the recorder via a patch cord to achieve speech compression and expansion. The VSC measures 3×6×6½ inches long. It is equipped with its own power amplifier and loudspeaker. It features volume and pitch controls, earphone jack and on-off switch. It operates off of AC power only. The price is $97.50. If the APH recorder and VSC module are purchased together the price of both units is $199.95. The VSC can be used with any cassette player or phonograph with variable speed controls as accessories.

CONSIDERATIONS FOR PERSONAL TYPE SPEECH COMPRESSION

If you are in the market for a speech compressor, the first decision you must consider is what format to choose: open reel, cassette or Talking Book (disc player). If you choose a cassette system, good design and controls are important features. Since many of the books are being produced in the four-track format, you will need a four-track, two-speed player. All of the players/recorders mentioned except the A7 and unaltered units from S.F.B. have four-track capability.

Recorders that contain integrated circuit controls permit the operator to go from "play" to "fast forward" or to "rewind" without hitting the stop button, with no damage to the tape. Many recorders can even go from the rapid winding modes, back to "play," without the stop button being pressed first.

Another feature you will appreciate is a rapid pause control. This is a useful feature that will allow you to stop recording without pressing the stop button, thus avoiding switching clicks on the tape. This is a handy feature when studying and transcribing. Also, when recording, you can eliminate portions of the presentation.

Tone indexing is a 60 Hz. low frequency signal recorded on the tape along with whatever else you are recording. In the fast forward or rewind position, the recorded index tone becomes a high pitched "beep." If your cassette has a tone indexing feature, the operator can record a tone anywhere on the tape. This tone is extremely helpful, especially when searching for passages to be reviewed.

The cue feature is used in conjunction with the indexing, fast forward, and rewind modes. Cueing allows for previously recorded material to be heard audibly only in the fast forward and rewind modes. The operator can utilize the cue feature to identify recorded portions of the tape as well as indexing tones.

The second decision you must consider is your reading needs. Be specific and list them:

1. Do you read for pleasure? If so, what type of material do you read and how many hours do you spend reading?
2. Do you need to record lectures, meetings, etc.?
3. Do you need a portable unit with rechargeable batteries or a desk top unit or both?
4. Do you need four-track capability?
5. How fast do you want to read? (Compression) 1.5, 2, 2.5, 3 times normal speed?
6. How slow do you want to read (expansion)?
7. How critical is the playback in choosing a recorder?

After listing your needs, how then do you choose a speech compressor? For pleasure reading, the Library of Congress cassette players or the Talking Books are adequate. These units are for playback only and have a variable speed control feature. These players can be used by themselves for those who can understand tapes played at 1.5 times normal speed, or they can be mated to the AmBiChron, the APH pitch corrector or the LOC-1 to produce compressed speech. Since the Library of Congress players are free of charge to those eligible, purchasing the pitch corrector is relatively inexpensive.

Recording or playback. If you are going to purchase a cassette recorder rather than, or in addition to, the cassette player available from the L.O.C. network, you may want to seriously consider the player/recorders available from A.P.H., Science for the Blind or the Variable Speech Control Co. (two-track only). These recorders offer two and four-track capability, pause control and portability. They are less expensive than the desk top units.

The Varispeech II by Lexicon is the only four-track, two-speed desk top unit available. However, it is the most expensive, but has the highest quality. It does not have the portability of the smaller units or some of the desired features such as cue and review and tone indexing. If quality of the playback is a critical feature in choosing a speech compressor, the Varispeech II is the best unit available. This feature is not readily apparent when listening to tapes recorded by L.O.C. or other professional studios. However, when a recording of a lecture is made and then played back on the Varispeech II, the quality of the output is superior to that of other recorders.

For those individuals who need to expand (slow down) the tapes, the AmBiChron model 144 and the Lexicon are superior to those machines using the VSC technology. VSC technology makes use of shift registers commonly known as bucket brigade devices. The Lexicon and AmBiChron 144 employ a sampling technique called random access memory (RAM) which handles expansion much better than VSC technology.

The consumer must make a thorough analysis of his/her reading needs before choosing a deck. If you read for pleasure and are not interested in recording, the L.O.C. player mated to a pitch corrector is the least expensive unit available. For those who do a moderate amount of listening and recording, the A.P.H., S.F.B. or A7 units are adequate. If you are a college student or your job requires many hours of reading, choose a Varispeech II. No speech compressor combines the features of the smaller decks and the quality of the Varispeech II. The consumer must often make a trade-off when choosing a speech compressor to meet his needs.

CHARACTERISTICS CHART

	SPEECH COMPRESSORS			VARIABLE SPEED RECORDERS/PLAYERS				
	Lexicon	**VSC A7**	**TCS Recorder**	**GE 5105**	**Craig J-103**	**Craig 2629**	**APH**	**LOC Player**
PRICE	$595	$295	$275 $375	$85	$180	$155	$155	FREE[1]
COMPRESSION	V[2]	V[2]	V[2]	2S&V[3]	2S&V[3]	2S&V[3]	2S&V[3]	2S&V[3]
EXPANSION	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
PITCH CORRECTOR BUILT IN	Yes	Yes	Yes	No	No	No	No	No
VSC TECHNOLOGY	No	Yes	Yes	—	—	—	—	—
RAM TECHNOLOGY	Yes	No	No	—	—	—	—	—
CUE	No	Yes	Yes	Yes	Yes	No	Yes	Yes
REVIEW	No	Yes	Yes	Yes	Yes	No	Yes	Yes
PAUSE	Yes	Yes	Yes	Yes	Yes	No	Yes	No
TONE INDEXING	No	No	Acc.[4]	No	Acc.[4]	No	Yes	No
PLAY 2 TRACK	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
RECORD 2 TRACK	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No
PLAY 4 TRACK	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes
RECORD 4 TRACK	No	No	Yes	No	Yes	Yes	Yes	No
AC OPERATION	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
BATTERY OPER.	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
RECHARGEABLE BATTERY	No	No	Acc.[4]	Acc.[4]	Yes	No	Yes	Yes
CONDENSER MIC.	No	Yes	Yes	Yes	Yes	Yes	Yes	No

Symbol Key

[1] Free to those who are eligible
[2] V-variable
[3] 2S&V—2-speed & variable
[4] Acc.—Available as accessory

This reference chart illustrates the features available with each recorder. For a detailed description of the compression and expansion ranges as well as other features, please refer to the article.

CHARACTERISTICS CHART

PITCH CORRECTORS

This diagram illustrates which tape player/recorder can be mated to the three available pitch correctors.

Pitch Correctors	
APH-VSC ($97.50) AC only, Power AMP & Speaker included VSC Technology	GE-5105—Science for the Blind Craig J-103-Science for the Blind Craig 2629-Science for the Blind APH Recorder—American Printing House for the Blind LOC Player—Library of Congress LOC Talking Book—Library of Congress Sony 105-American Printing House for the Blind
LOC-1 ($95.00) No Power AMP or Speaker included AC only VSC Technology	LOC Player—Library of Congress Cassette 4 Track—Library of Congress
AmBiChron 144 ($198.00) AC & DC, Speaker and Power Supply included, RAM Technology	GE 5105—Science for the Blind Craig J-103—Science for the Blind Craig 2629—Science for the Blind APH Recorder—American Printing House for the Blind LOC Player—Library of Congress LOC Talking Book—Library of Congress Sony 105-A—American Printing House for the Blind

Resources for Speech Compression, Variable Speech Recorders/ Players and Pitch Correctors

Where to purchase the previously described units:	**Division of the Blind and Visually Handicapped**
Library of Congress Washington, D.C. 20542	LOC Player
American Printing House for the Blind 1839 Frankfort Ave. Louisville, KY 40206	APH VSC
Variable Speech Control Co. 185 Berry St. San Francisco, CA 94107	A7 LOC-1 AV-1
Science for the Blind Box 385 Wayne, PA 19087	GE 5105 Craig J-103 Craig 2629 AmBiChron Model 144
Lexicon, Inc. 60 Turner St. Waltham, MA 02154	Varispeed II LOC Note: Production Discontinued

For more information concerning this article please contact: Leonard Mowinski or Harvey Lauer, Hines VA Hospital, Hines, IL 60141—(312) 343-7200 Ext. 2278, 2418

SPEED LISTENING IN A FAST-MOVING WORLD GOODBYE DONALD DUCK, HELLO SPEECH COMPRESSION

by Harvey Lauer

The following remarks are written from the point of view of a consumer, teacher and researcher in communication aids for blind people.

When we read braille or print, we have some choice of the rate. When recordings were introduced, we had to give up the choice of speed except for the "Donald Duck" effect which was tolerated mainly by desperate students and professionals. Now electronic speech compressors are becoming available. The better ones cause much less distortion than results from merely speeding up recordings, commonly called "Donald Ducking." That's why I like to say that speech compression is putting us back into the driver's seat when we learn through listening.

Reading is probably most efficient and certainly most rewarding when the reader can choose his pace according to four factors. These are the reader's abilities, his needs, the relative difficulty of the subject matter for him, and the quality of the material being read. The fourth factor, quality, is a major current concern for three reasons. First of all, the technology of speech compression is new and rapidly evolving as yet. Secondly, speech compression places a premium on quality recordings and players. For example, a marginally intelligible recording can only be made worse by speeding it up or adding speech compression. Thirdly, tape recorders are most often treated as toys of an affluent or technological society. Since we need them as tools, it will be helpful to examine the typical differences between toys and tools in our culture.

We need to treat our recorders and record players differently from the ways in which toys are typically handled. In general, toys tend to be cheaper and less reliable than tools. Sometimes expensive toys provide needed reliability, and sometimes they only provide unneeded frills which can even reduce reliability. Users tend to be less critical of the performance of their toys and more careless in using and maintaining them. A blind person using a recorder as a study aid needs a more durable and reliable instrument than does a hobbyist who makes recordings at family reunions. However, the cheaper machines may serve us well as back-up systems and for lending to readers.

We will therefore profit by taking the following steps in the use of tape machines, especially when we plan to speed up the playback with or without speech compression (pitch correction.)

(1) Follow the manufacturer's rules for care and maintenance, so often neglected by the casual hobbyist. Keep heads and drive surfaces clean.

(2) Learn enough about the mechanics of cassette tapes to prevent most jams, spills and take-up slack. You can learn to move efficiently from place to place on a tape.

(3) Learn the basic principles of microphoning and teach them to your readers. Learn how to copy tapes and make recordings from other sound sources using patch cords, not microphones.

(4) Make an effort to find out which machines will best meet individual needs. Do this by reading consumer articles and consulting with knowledgeable users and trusted dealers.

(5) Finally, remember that tools should serve to extend human capabilities. They are neither adversaries to be conquered nor the means to a carefree existence. Notwithstanding many recent improvements in machines and tapes, they require care and instruction in their use. Because they have many moving parts and moving tapes, it's a mistake to treat them like radios which can be made largely maintenance free.

For children and for newly blinded adults, teachers and rehabilitation workers are the major source for this new technology and these new skills. For that reason, the above comments go double for teachers and rehabilitation workers.

Speech compression has come of age. It's catching on among blind people. A few sighted people are using it. I expect improvements in the next several years to bring many more sighted people into the market for speech compression. If that happens, the prices will come down and the speed with which we read will go up. History may then rate the invention of the speech compressor along with the phonograph and tape recorder as to its value for blind people. However, people who need to read faster or slower need not wait for improvements. In my opinion, many speech compressors are now worth their cost.

A CONSUMER'S EVALUATION

by Hadi Madjid, Ph.D.

As a consumer, Hadi Madjid, Ph.D. has contributed the following information that he has gathered in his own investigation of personal type speech compression. Dr. Madjid has been involved in other similar investigations and evaluations for himself and professional organizations such as The American Foundation for the Blind. His evaluation of the speech compressors and pitch correcting adapters is based on the following criteria: Speech Intelligibility, Tonal Quality, Pitch/Speed, Ease of Operation, Advantages and Disadvantages.

SPEECH COMPRESSORS

Lexicon Varispeech

Speech Intelligibility:	Excellent.
Tonal Quality:	Excellent.
Pitch/Speed:	Excellent; has single control for speed and pitch correction.
Ease of Operation:	Good for all basic functions; the speed control knob is not marked for blind use and the four-track and two-speed switches can be difficult to find and use.
Advantages:	Machine can be adapted for two-speed/four-track cassette use; system can be used as an adapter with any variable speed player.
Disadvantages:	Machine is bulky and operates only on AC; during rewind there is no audible sound and therefore it is very difficult to know how far to rewind when a segment is to be repeated.

TCS

Speech Intelligibility:	Good.
Tonal Quality:	Good but noticeable background hum at higher speeds.
Pitch/Speed:	The speed range for this unit seemed limited; as speeds are increased, quality of compressed speech seems to diminish; separate controls for speech and pitch correction.
Ease of Operation:	The standard knobs were recessed and difficult to use. The adapted switches protrude greatly and therefore may be easily damaged.
Advantages:	Audible fast forward and rewind; optional tone indexes available.
Disadvantages:	The system tested would not speech compress when powered only by batteries; new TCS's have rechargeable battery system and will speech compress on internal battery supply.

VSC A7

Speech Intelligibility:	Good.
Tonal Quality:	Good but with noticeable motor hum at high speeds.
Pitch/Speed:	Good; has single controls for speech and pitch correction.
Ease of Operation:	Good for all functions.
Advantages:	System can be used in battery operation and therefore is portable; has cue and review function; system can be used as an adapter with any variable speed player.
Disadvantages:	The system does not play four-track/two-speed cassettes.

PITCH CORRECTORS

APH Adapter

Speech Intelligibility:	Superior sound.
Tonal Quality:	Good but with excessive background noise.
Pitch:	Good; has single pitch correcting control.
Advantages:	APH has its own built-in amplifier and speaker which allow it to be used with any variable speed player.
Disadvantages:	AC power does not allow portable use; it was also noted that with the particular unit tested occasionally the sound would cut out.

AmBiChron 101 Adapter

NOTE: The model tested was the discontinued Model 101 which does not have a built-in amplifier or speaker. The Model 144 does have an internal amplifier and speaker.

Speech Intelligibility:	Excellent.
Tonal Quality:	Raspy.
Pitch:	Good; has single pitch correcting control.
Advantages:	Powered by battery which allows it to be portable; built-in cables eliminate the need for auxiliary cables; Model 144 can be used with any variable speed player.
Disadvantages:	The cables on the Model 101 had plug housings that were large, causing them to fit too closely together when plugged into the LOC player; Model 101 is designed for use with LOC player only.

LOC 1

Speech Intelligibility:	Good.
Tonal quality:	Good.
Pitch:	Good; has single pitch correcting control.
Advantages:	Built-in cables eliminate the need for auxiliary cables.
Disadvantages:	AC powered only does not allow for portability; placement of braille labeling on the rear of the unit is too close to the cables, making them difficult to read.

A major advantage for adapters is that the expense is reduced because they are designed to be used with a variable speed player.

A major disadvantage is that when using an adapter one has two separate controls that must be matched, one for speed and one for pitch correction.

BIBLIOGRAPHY ON SPEECH COMPRESSION

The following partial bibliograpy on speech compression lists primarily literature that has application to the concerns of the visually impaired population. A more comprehensive listing of the history and technology of speech compression can be obtained through the following resources:

Resources

Center for Rate Controlled Recordings. *Proceedings of the Louisville Conference on Time-Compressed Speech*, University of Louisville, Oct. 19-21, 1966. (Edited by Emerson Foulke)

Center For Rate Controlled Recordings. *Proceedings of the Second Louisville Conference on Rate and/or Frequency-Controlled Speech*, University of Louisville, Oct. 22-24, 1969.

Center For Rate Controlled Recordings. Proceedings of the Third Louisville Conference on Rate-Controlled Speech, University of Louisville, 1975. (Edited by Emerson Foulke)

Duker, Sam. *Time Compressed Speech: An Anthology and Bibliography in Three Volumes.* Metuchen,N.J.: Scarecrow Press, 1974.

ABRIDGED BIBLIOGRAPHY

Bell Laboratories Record. "Speed Hearing for the Blind with New Electronic Device." #43, 1965, pp. 462-463.

Bellamy, Martha J. "An Experimental Study to Compare the Compression of Speeded Speech by Blind and Sighted Children." Master's Thesis, Univ. of Texas, Austin, Texas, 1966.

Benham T.A. "Analysis of Production in a Speech Compression Center." Science for the Blind, 1966. 11 pp.

Carroll, John B. and Cramer, H. Leslie. "The Intelligibility of Time-Compressed Speech." Final Report. Office of Education Contract OEC 7-31-0370-271. Cambridge, MA: Harvard U., 1968. ED 021 851.

Connor, Aikin. "Compressed Speech, Listening Skills, and Handicapped Students." In *Selected Papers, Association for the Education of the Visually Handicapped, 52nd Biennial Conference.* San Francisco, CA, June, 1974, pp. 80-90.

Crowley, Francis J., Lake, Barbara W. and Rathgraber, Sister Jean Marie. "A Comparison of the Listening Ability of Blind Students and the Listening Ability of Sighted Students in the Intermediate Grades," U.S. Office of Education Grant No. OEG-32-42-0440-1005. Bronx, NY: Fordham U., 1965. ED 021 373.

De l'Aune, W. et al. "Speech Compression and Blinded Veterans." Paper presented at the Conference on Devices and Systems for the Disabled, Philadelphia, PA, April 30, 1975.

De l'Aune, W. et al. "Speech Compression: Personality Correlates of Successful Use." *Journal of Visual Impairment and Blindness*, 71:2 (Feb. 1977), pp. 66-70,

Flowers, David M. "Effects of Compressed and Expanded Speech on Intelligibility on Blind and Sighted Inividuals with Normal and Retarded Intellect." Dissertation, School of Education of Syracuse University, August 1972. University Microfilms #73-9583.

Foulke, Emerson. "Comparison of Comprehension of Two Forms of Compressed Speech." *Exceptional Children*, #33 (1966), pp. 169-173.

Foulke, Emerson. "Comparison of Harmonic Compression and Compression by the Sampling Method." *AFB Research Bulletin*, #23 (June 1971), pp. 100-102.

Foulke, Emerson. "A Discussion of Reading by Listening and by Touch." *Proceedings of the Conference on Communicating by Language: The Reading Process.* Bethesda, MD: Dept. of HEW, Public Health Service, National Institutes of Health, National Institutes of Child Health and Development, 1968,177-195.

Foulke, Emerson. "Effectiveness and Efficiency of Reading by Listening." *Proceedings of the Louis Braille British Conference on Research into Reading and Listening by the Visually Handicapped*, 1975. Southern Regional Association for the Blind, pp. 98-113.

Foulke, Emerson. "The Influence of a Reader's Voice and Style of Reading on Comprehension of Time-Compressed Speech." *The Perception of Language* (edited by David L. Horton and James J. Jenkins.) Columbus, OH: Charles E. Merrill, 1971, pp. 79-107.

Foulke, Emerson. "Reading by Listening." *Proceedings: Special Study Institute*, Tennessee Educators of Visually Handicapped Pupils. Louisville, KY: American Printing House for the Blind, 1969, pp. 32-35.

Foulke, Emerson. "A Survey of the Acceptability of Rapid Speech." *New Outlook for the Blind*, #60 (1966), pp. 261-265.

Foulke, Emerson. "A Survey of the Acceptability of Rapid Speech." Technical Report, Project #2430, Cooperative Research Branch, Dept. of HEW. Office of Education. Louisville, KY: Performance Research Laboratory, U. of Louisville, 1965.

Foulke, Emerson. "Time-Compressed Recorded Speech and Faster Aural Reading." *Blindness, 1967*, the American Association of Workers for the Blind Annual, Washington, DC: The Association. 1967, pp. 11-20.

Foulke, Emerson. "Time Compressed Speech: An Advance in Aural Communication." *Home Teacher*, #10 (1967), pp. 31-40.

Foulke, Emerson and Bixler, Ray H. "Speech Compression." *New Beacon* #47 (1963), pp. 241-242.

Foulke, Emerson and Jacques Robinson. "The Development of Accelerated Speech as a Useful Communication Tool in the Education of Blind and Other Handicapped Children." Progress Report. Project #7-1254 covering May 1, 1969-Jan. 31, 1970. Grant #OEG-0-8-071254-3527 (032). D.C.: Dept. of HEW, Office of Education, 1970.

Foulke, Emerson and Sticht, Thomas G. "Listening Rate Preferences of College Students for Literary Material of Moderate Difficulty." *Journal of Auditory Research*, #6 (1966), pp. 397-401. (This article is a Summary of Chapter 9 of Part III of *The Comprehension of Rapid Speech by the Blind.)*

Foulke, Emerson and Sticht, Thomas G., "Review of Research on the Intelligibility and Comprehension of Accelerated Speech." *Psychological Bulletin*, #72 (1969), pp. 50-62.

Gore, George V. III. "Comparison of Two Methods of Speeded Speech." *Education of the Visually Handicapped*, Vol. 1, #3, (Oct. 1969), pp. 69-76.

Grumpelt, Howard R. and Rubin, Ellen. "Speed Listening Skills by Blind as a Function of Training." *Journal of Educational Research*, 65:10, (July-August 1972), pp. 467-471.

Insider Report. "Fast or Slow: New Tape Player/Recorder Offers Multi-speed Selection." May 1978. Curriculum Product Review.

Lawton, Robert E. "Listening to Rate Controlled Speech: A Technique for Improving Education and Communication." Grad. Thesis. Maxwell A.F.B., AL: Air U., 1967. Also, George Washington U., Washington, D.C., 1967.

McLain, Julie R. "A Comparison of Two Methods of Producing Rapid Speech." *International Journal for the Education of the Blind*, 12 (1962) pp. 40-42.

Myers, Jean Ann. "Compressed Speech Increases Learning Efficiency." *Education of the Visually Handicapped*, 10:2 (Summer 1978), pp. 56-64.

Rawls, Rachel F. "Training for Increased Comprehension with Accelerated Word Rates in Auditory Reading Media," Ph.D. Thesis, North Carolina State U., 1970. *Dissertation Abstracts* 31: 2263B, 1971.

Schiffman, Murray. "Playback Control Speeds or Slows Taped Speech Without Distortion." *Electronics*, Aug. 22, 1974, pp. 87-94.

Turtle, Dean W. "Comparison of Three Reading Media for the Blind: Braille, Normal Recording, and Compressed Speech." *Education of the Visually Handicapped*, 4:2, May 1972, pp. 40-44.

NEWS FROM THE FIELD

New Aids and Appliances Catalogs for 1980-1981

American Foundation for the Blind has recently issued their 1980-81 catalog, "Products for People with Vision Problems." Included in this catalog is a new line of products incorporating voice technology. The new talking aids include Talking Time, a talking scale, Digit-Cal talking caliper, a talking clock radio and a talking multimeter.

American Foundation for the Blind
Consumer Products Division
15 West 16th Street
New York, NY 10011

American Printing House for the Blind is now publishing their 1980 "Catalog of Educational and other Aids." This catalog is in a new 8½" x 11" format with items categorized in 12 sections. These sections include such titles as Braille Papers, Notebooks and Book Binders, Educational Games, and Mathematics Aids.

American Printing House for the Blind
P.O. Box 6085
Louisville, KY 40206

Independent Living Aids, Inc. has just published the 1980-81 edition of their catalog, "Aids and Appliances for the Blind and Visually Impaired." This is an expanded catalog including many new listings. Also included is a line of vitamins, toiletries, and health and beauty aids.

Independent Living Aids, Inc.
11 Commercial Court
Plainview, NY 11803

Science for the Blind's Fall 1980 catalog is now available. The printed edition, "Print-A-Log," contains information on many aids and materials for the visually impaired. This catalog also has many new products listed such as compressed speech modules, voice and sound games, and adapted scientific and technical products.

SFB Products
Box 385
Wayne, PA 19087

New Aids and Appliances Organization

A fairly new organization offering technical products for the visually impaired population is Innovative Rehabilitation Technology, Inc. I.R.T.I.'s primary function is to provide quality products which offer day-to-day utility and state-of-the-art sophistication to the handicapped population. Another service I.R.T.I. will offer in the future will be dealing with the employment development of handicapped persons. Their current catalog lists such items as a wide angle mobility light, braille compass, talking computer systems, various timepieces, a tactile drawing kit and a cassette recording device.

I.R.T.I.
375 District Circle
Suite A-11
Los Altos, CA 94022

New Publications

Two new publications of interest have come to our attention recently. *Rehab Newsletter* is published quarterly by Visualtek. Its purpose is to help keep people acquainted with what's going on in the rehabilitation community concerned with blindness and vision impairment with special emphasis on low vision. Although most of the news features pertain in some respects to Visualtek products, the articles are interesting and informative. *Rehab Newsletter* is available from:

Visualtek
1610 26th Street
Santa Monica, CA 90404

Smith-Kettlewell Technical File is a new quarterly journal for blind and visually impaired persons who are interested in current technology. Directed towards hobbyists, students and professionals, the newsletter provides electronics and mechanical information such as catalog abstracts, manufacturers' application notes and construction detail on devices for the blind. General interest "do it yourself" descriptions of such processes as soldering project layouts and the use of power tools will focus directly on techniques used by the blind.

Published by the Rehabilitation Engineering Center of the Smith-Kettlewell Institute of Visual Science, the journal is available, for a subscription fee, in braille, large print and talking book editions. For further information contact:

William Gerrey, Editor
Smith-Kettlewell Institute of Visual Sciences
2232 Webster Street
San Francisco, CA 94115

PROBLEM CORNER

We are currently in the process of gathering information and resources for an issue of AAR on marketing and labeling techniques. We have uncovered many different personal systems that individuals have been using to identify a wide variety of items. The usual methods taught by rehabilitation teachers have been useful to many visually impaired persons. There are also those individuals for whom standard marking and labeling techniques do not work or items/tasks for which these techniques are not effective. We are therefore requesting that you, the professional or consumer, share with us the techniques which you may have found effective in the area of marking and labeling. Especially valuable will be alternative methods employed in unusual situations. We would appreciate your timely response so that we may be able to include these ideas, methods or systems in an upcoming issue of AAR.

The Carroll Center for the Blind gratefully acknowledges a grant from the Cowan Foundation which has made this publication possible.

gmk

AIDS AND APPLIANCES REVIEW

THE CARROLL CENTER FOR THE BLIND
770 Centre Street, Newton, MA 02158
(617) 969-6200

Issue No. 5
Technical Writer: Marlene Gast

December, 1981
Editor: Robert McGillivray

This issue of AAR has been in preparation for well over a year, and during that time the efforts to compile resources and techniques for labeling have been coordinated by Nancy Campbell, rehabilitation teacher at The Carroll Center. Mrs.Campbell drafted the text of the Review and supervised each stage of revision as well as the issue's final shaping and polishing. The techniques compiled here have evolved from her experience teaching the use of alternative labels, and from ideas provided by colleagues in the field of vision loss. The people who contributed to this issue are too numerous to name individually; we hope they are aware of our gratitude for their help and ideas.

ALTERNATIVE LABELS: AIDS FOR INDEPENDENT LIVING

INTRODUCTION

Loss of vision is a frustrating experience which frequently affects the person in nearly every phase of life. Among other losses, distinguishing one similar item from another is one common task that the person may now be unable to accomplish. Having lost the ability to identify clothing by color, the person can no longer choose a particular garment from a crowded closet (perhaps a blue shirt rather than a yellow one). With vision loss, a person may be unable to decipher either a label's print or even its distinctive colors and design. He or she is now unable to read the labels which indicate the particular contents of similar containers (such as toothpaste rather than hair cream in a tube, or chicken noodle rather than tomato in a soup can). Without sight, distinguishing one vial of prescribed medication from another is possibly risky as well as difficult. To distinguish and select these essential items, the person could, of course, depend on the aid of someone with sight, perhaps a family member. But the resultant dependence can become another undesirable consequence of vision loss. When loss of vision makes reading labels difficult or impossible, it diminishes a person's control over daily life.

But even with vision loss, *alternative labels* can aid in restoring much of a person's independence in daily living. These labels can be specially designed to be recognized through touch, through hearing, or through the particular capacities of low vision. Alternative labels can be attached both to containers already labeled—such as canned goods—and to items ordinarily not labeled with particular identifying information—such as clothing. Moreover, the systematic arrangement of items stored on shelves, in drawers, cabinets and closets can also help a person to locate and identify the things he or she needs, even minimizing the necessity of making alternative labels. These methods of organization together with alternative labels can enable the person to regain control over the activities of daily life—dressing, cooking, keeping household records and paying bills, and even just choosing music for the stereo at the end of a busy day.

In this issue of AAR, we discuss in detail nonvisual and low vision labeling techniques and materials. The issue begins with a look at practical considerations in making labels, then explores media, materials, and uses for labels. We have categorized labels according to the kind of perception used to decipher them; the categories include various kinds of tactile labels, including braille labels in large print for low vision, and audible labels in the form of "talk cards." The section following comprises excerpts from "Braille Labeling and Managing Food and Supplies for the Blind Homemaker" by Mrs. Gladys E. Loeb. And the final section presents a system for using alternative labeling techniques in managing personal and household business as well as common daily tasks. In addition, this issue of AAR encloses a guide to resources for alternative labeling materials.

Our information comes both from our experience and research at The Carroll Center and from suppliers and manufacturers of alternative labels or labeling materials. Yet we know that individuals have discovered their own materials and approaches to alternative labeling. We invite responses about your individual techniques so that we may share this information in the future.

DESIGN CONSIDERATIONS

The material and the design of the label will, of course, be determined by the perceptual abilities of the individual who has experienced a loss of vision. For a person who reads braille, for example, that medium is the obvious choice; and embossing tape, which readily receives and holds braille, would be an appropriate labeling material.

But the physical nature of the labeling materials alone will also influence the decision on label design. The appropriateness of a given labeling material will depend not only on its ability to receive braille or embossed letters or some other kind of nonvisual or low vision sign; but the appropriateness of a material will depend also on the shape, size, household location, and potential uses of the item to be labeled. In fact, these physical factors should be taken into account first in choosing labeling materials and design.

Permanence

One should first decide whether the label itself will be placed on the item permanently or whether the label should be designed to be removed and used again. This will help to determine the type of material for the label and even the type of marking used for some labels. For example, a reusable label can be made from magnetic tape which will receive braille. Such a label adheres magnetically to a steel can and can later be removed intact, ready to be placed on a new can when the old can is emptied and discarded.

Durability

The durability of a material under the conditions of use is important. Its reaction to frequent handling, to moisture, to heat and cold, and to body or cooking oils should be considered. Paper products wear out quickly; water-based felt-tipped pens smudge easily; thin plastic materials may melt when near a heat source or can become brittle if used in a freezer. Also, the labeling material must be flexible if the label is to conform to the shape of the object labeled.

Placement

When placing a label on an item, be sure that it does not interfere with the opening or use of the container itself; and it must not interfere with existing printed information which will be read by persons with sight. The label should either be placed so as not to cover printed matter, or it could be made of a clear material.

Attachment

The method of attaching a label to an item will vary with each person's needs and resources and with the shape of the item being labeled. Labels can be attached by rubber bands, adhesive products, various types of tape (transparent, marking, double-faced, or self-adhesive embossing tape); they can be sewn on such items as clothing, or they may be adhered to small magnets or magnetic tape which in turn holds to cans made of steel.

Introductory Tip

As you begin to read about alternative labeling techniques, we would like first to put in a word for organizational skills. Although alternative labels enable one to identify an item once it is located, the organized storage of items can serve as an essential first step in the retrieval of information, materials, or equipment. Arranging items into categories and assigning the separate categories to specific storage areas can help identify an item, regardless of label. Making special labels obviously takes time, effort, and materials. Reducing the need for great numbers of specially made labels by systematically storing items can be both more efficient and more economical.

TACTILE LABELS

INTRODUCTION

Imagine that it is 5:00 P.M. and time to start dinner by opening the kitchen cabinets and taking out the noodles, mushroom soup, and tuna needed for the casserole. With sight, one's eyes scan the shelves for the familiar tall white box, its cellophane window showing noodles and its red and blue print spelling "Mueller's;" it is easy to reach for the mushroom soup between the tomato and chicken vegetable soup because the label spells out the word; and immediately one recognizes the "Chicken of the Sea" mermaid picture and grabs the tuna, even though it rests next to the boned chicken in a similarly shaped can.

But *how* is a person with vision loss able to find products needed in preparing a meal or carrying out any other daily activity? One way is through the use of tactile labels (labels that provide identifying information through touch): labels in braille; miniature plastic fruits or vegetables backed with magnets; palpable notches filed into the rims of soup cans—one for tomato, two for mushroom—or a single noodle taken from the box and glued to its top. These are examples from among the myriad of materials and procedures that can make up tactile labeling, detailed here in this first section. With such tactile labels attached to canned goods, jars, boxes, and cartons, a person with vision loss can reach into the kitchen cupboard and use the fingertips to scan its contents. The person recognizes the narrow, roughish curl of a noodle glued to a box top, reads "tuna" brailled on the vinyl embossing tape encircling the can, and feels the rim of a mushroom soup can with its two identifying notches. In this way, a person with vision loss can accomplish the first step in cooking tuna casserole for the evening meal.

The following section discusses separately each kind of tactile label by describing materials and techniques for coding items with tactile symbols and for embossing braille and other tactile characters on alternative labels.

TACTILE SYMBOLS AND CODES AS LABELS

A tactile symbol consists of some shape or texture which can be recognized through touch; the tactually recognizable shape or texture *represents* the item to be identified. (The noodle glued to the Mueller's box, described in the introduction here, is an example of a tactile symbol.) Various patterns and arrangements of tactile symbols can form a tactile code. For instance, the pattern or systematic placement of closed safety pins under the collars of dresses can indicate their colors (two parallel pins for red, two crossed pins for blue). Or sets of notches on the rims of soup cans might signal the kind of soup (one notch for tomato, two for mushroom, three for chicken noodle). The basic requirement for such a code is that it must trigger recognition. Because a person must remember the symbol or code and its assigned meaning, straightforward design and frequent use are of key importance.

Basically, tactile symbols and codes fall into one of two categories: either some identifying object or material can be attached to an item, or the exterior of an item itself can undergo a physical alteration (such as the rims of soup cans which can receive patterns of notches to identify them). Below we first suggest some procedures for tactile coding through physical alteration, and we then list materials and suggest systems for coding through applying substances and attaching identifying objects.

But first we would like to note that even without this alternative labeling, tactual recognition of some items is possible. A unique wrapper or label or container shape can help make an item recognizable through touch. Certain kinds and brands of liquor, for instance, come in distinctive bottles, as do catsup and mustard, for another example.

Physical Alteration

The exterior or packaging of many items and products can be easily marked by minor scratches or tears which can be recognized by touch and which can then symbolically represent the contents. By their number and arrangement, *notches* cut with scissors or even *rips* simply torn into paper labels and packaging can identify contents. One notch on the box top of a package of crackers can indicate "Wheat Thins" as the contents, while two notches on another box top can indicate "Triscuits." On a tape cassette a *tactile groove* made with a three-cornered file may be used to record such information as the length of tape contained. And as described earlier, *notches* filed on the rims of canned goods can signal their contents, but care must be taken not to perforate the can's seal.

One notch in the can's rim (left) indicates "whole kernel corn" while two notches (right) mean "cream style corn."

Applied Objects and Substances

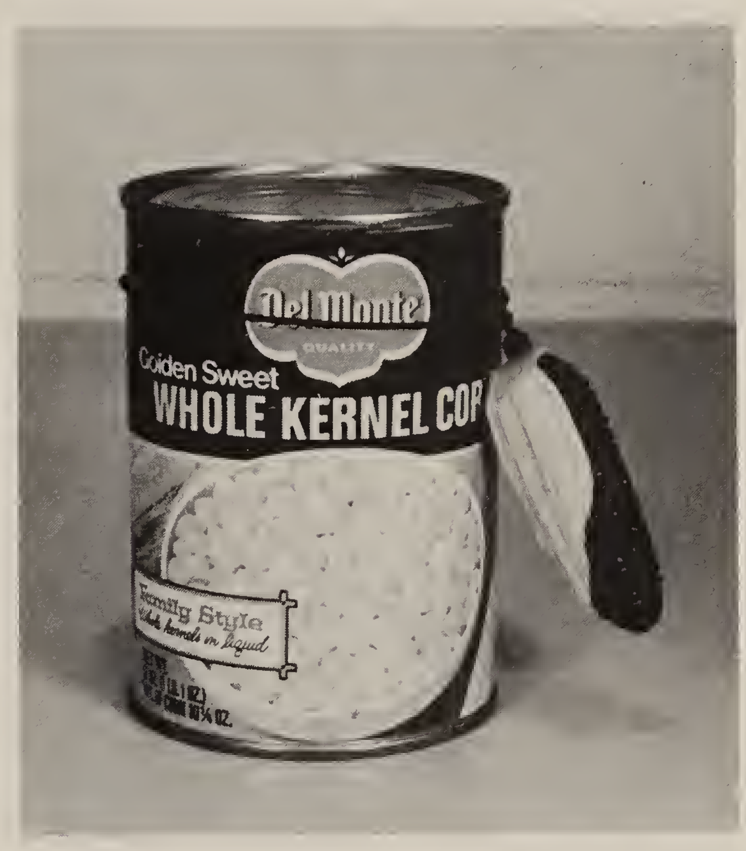
If the surface of an item or product should stay intact, then it may be labeled by applying a variety of common objects or substances. Again, this approach to labeling consists, in principle, of applying objects or substances which can be distinguished through touch, objects or substances to which meaning has been assigned. For instances, *staples* by their number, arrangement, and spacing may encode information about papers, bills, documents, or clothing. On clothing, various patterns and numbers of *brass safety pins* and *embroidery knots* can indicate color as well as other garment information. Likewise, stretched around cans, *rubber bands* can identify the contents inside: a can with no rubber band could be recognized as chicken noodle soup, while cans with one rubber band might designate tomato. Three bands might signify vegetable beef. Bands of *plastic wrap* or *aluminum foil* wrapped around articles and cans identify items in the same way as rubber bands.

The "whole kernel corn" has one rubber band while the "cream style corn" has two.

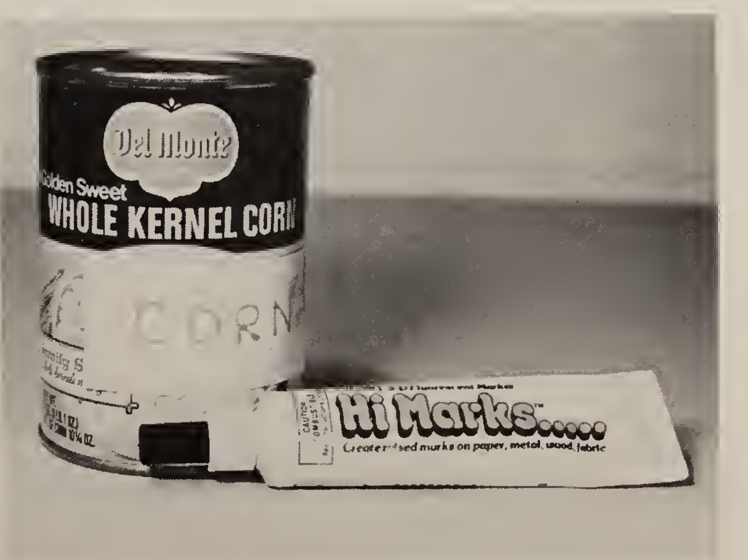
Fabric pieces with distinctive textures—corduroy, satin, a swatch cut with pinking shears—can also provide labeling information. For example, one could use a corduroy strip to indicate all canned vegetables, while satin strips could indicate all canned fruits. Other tactile marks such as *notches* on the rims of cans would, by their particular number, indicate the kinds of fruits or vegetables contained.

Treated with a fixative and attached to freezer packages by elastics, *chicken drumstick bones* or *beef "T" bones* or *pork chop bones* can indicate the frozen food contained. Glued on the outside of canisters or packages, *rice, noodles, screws, buttons,* etc., can replicate the contents.

LOBELS, a simple non-braille marking system devised by Mrs. Gladys E. Loeb, and available from the Loeb Foundation, uses miniature plastic representations of fruits, nuts, vegetables, meats, fish, etc., to provide easy identification for the blind homemaker. Each marker is provided with an elastic band or magnet to attach to a can or package.



HI MARKS, a substance squeezed from a tube like glue, dries hard and holds the raised shape it is given; these tactile shapes, by their number and arrangement, can serve to identify an item.



Hi Marks can also spell out an identifying word in tactile letters.

Finally, *tape* can be used as a tactile marker—a bold "T" may be felt and then read to indicate tomatoes, or small pieces of tape in a random pattern on a can could suggest peas, for example.

Black electrical tape makes the bold "C" which stands for corn; the tape's distinctive texture and "C" shape make a tactile label.

Embossed Lines

Embossed on paper or plastic or perhaps wide embossing tape, *raised lines* can be used to make up identifying codes. By their specific lengths, arrangements, and numbers, raised lines could indicate the particular contents of a can or package just as any of the other tactile codes. The following equipment makes raised lines on the material indicated.

The *Raised Line Drawing Kit* includes a rubber-covered drawing board for use with a package of mylar polyester film sheets (8½ x 11 inches) and a stylus similar to a ball-point pen. The raised lines are easily felt on the plastic, but the thinness of the plastic makes attaching it to articles difficult.

The *Felt Drawing Board* (from Science Products for the Blind) can also make raised lines on various materials, and the *Sensory Quill* (from Mechstat, Inc.) which makes raised drawings or writing on braille paper, can obviously make raised lines as well as raised drawings or letters.

For devising labeling codes, the possible materials and combinations of patterns or marks are almost unlimited. Any code, in fact, is limited only by the person's imagination and by his or her ability to remember the meaning given each sign and its arrangement.

BRAILLE LABELS

Braille, for persons who can read it, is an especially practical and versatile system of writing for tactile labels. Below, on page of this issue, we provide excerpts from Mrs. Gladys Loeb's pamphlet detailing her comprehensive approach to braille labeling for food and household supplies. Many of Mrs. Loeb's suggestions could be specifically adapted to braille labeling on other household products or for office needs. Here, in this section, we offer a general description of braille as well as general guidelines in choosing materials and equipment for making braille labels.

Braille is, by definition, a system of writing for the blind that uses characters made up of raised dots. Through touch, the characters are deciphered and the writing is interpreted. Basically, a line of braille writing is composed of individual braille cells, and the braille cells are each composed of a specific configuration of up to six raised, palpable dots. Each specific configuration of these dots represents a specific letter of the alphabet or signifies a specific set of letters. A total of 258 distinct characters and letter sets is possible. Each blank space between letters and words, as well as each configuration of raised dots, occupies a cell.

Because the braille cell is just smaller than the size of a fingertip, braille is particularly suitable for labels on household containers or on office files, supplies, and documents. The relative smallness of the characters contributes to the compactness of labels. For people who read braille, it is also a good labeling choice because of the versatility of the kind of identifying information it can convey. Braille can 1) directly transcribe the printed word of an existing label; 2) make contractions for some printed words, thus fitting into a label's limited space; or 3) give the identifying initials of an item.

Even if a person has not learned the characters and word signs of the braille system, any configuration of the raised dots of the braille cell can be assigned an identifying meaning to be used as a symbol in a code. Thus, the single dot of the braille character for "A" might arbitrarily be assigned the meaning of canned soup, while the two dots in a horizontal line (the braille "C") might be assigned the meaning of cream of chicken, and the two dots in a vertical line (the braille "B") might be called beef noodle; then a label embossed with a single dot followed by two dots in a vertical line would indicate beef noodle soup—even if the person using the code could not read the whole braille system. This is one example of how individual braille characters can be used as symbols in a personally designed code to identify selected items.

Material for Making Braille Labels

Material onto which braille may be embossed, and then used as labels, can be divided into three categories: materials manufactured especially to receive braille, commercially-available embossing tape, and plastic and paper products commonly available in most households. The variety of materials compatible with braille to be used as labels contributes to the versatility of braille. In this section, we briefly describe specific examples and brands of these materials with their potential uses, advantages, and limitations.

Braillabel belongs to the category of materials manufactured especially for braille. It is a durable plastic, which comes in sheet form, with pressure-sensitive backing protected by peel-away film covering. It can be embossed in a braille writer or slate, cut to size, and adhered to any smooth surface—plastic, metal, painted wood. It is useful for labeling books, shelves, and canned goods.

Thermoform paper (trade name *Brailon*), also available in sheets, is excellent for labels because it is moisture and oil proof and therefore makes relatively permanent braille.

Labelon tape, available in rolls, is a pressure-sensitive tape which may be brailled on a standard braille slate. Three-quarter-inch tape takes one line of braille; one-inch tape takes two lines of braille.

Generally, *embossing tape*, which is available from several manufacturers and distributors for a variety of purposes, comes in clear, colored, magnetic, and aluminum varieties. Embossing tape has a peel-away backing which exposes an adhesive backing. It is adequate for labeling paper; but, generally, when used for equipment that will be handled a great deal, it requires additional adhesive. Likewise, it does not generally adhere well enough for use in areas where grease and oil accumulate or where temperature changes occur such as near a cooking range. However, embossing tape has been found especially useful for products and items that remain in storage areas much of the time and for the edges of shelves.

The variety of kinds of embossing tape permits a variety of task-specific labels in braille. When brailled, *clear embossing tape* can cover print on original labels without obscuring the message for sighted readers. *Rotex* (brand) tape is clear and lightweight for easier brailling and better adhesion. *Colored tape* offers an added identification of category for a person with residual or low vision. Colors can more easily identify categories—for example, red for canned fruits, green for labels identifying vegetables—while braille characters on the colored tapes can specify the kind of fruit or vegetable.

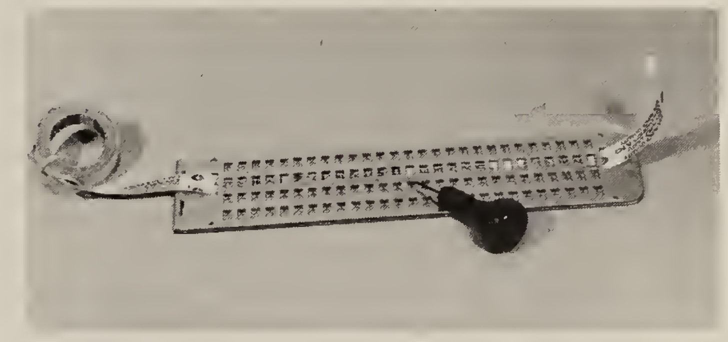
Embossing tape can be adhered to heavy magnetic strips for reusable labels. Reusable labels can also be made from *lightweight magnetic tape* which itself may be brailled directly; but its bond is not strong, so it is not adequate for all purposes. Also durable is *aluminum tape* which can be used in the freezer, garage or shop areas.

Materials commonly available in the household can be brailled and used for labels: *plastic strips* cut from vinyl sheets purchased in stationery stores can be brailled and adhered to an item with glue or attached with an elastic band fastened to the label through holes punched at each end, which can then be stretched around an item such as a can; *plastic from greeting card boxes, etc.* can also be used like vinyl; *note cards reinforced with wide transparent tape* can be brailled over the tape and used on items in the refrigerator; or any *paper, cards, tags* in a suitable size can be brailled to serve as a label.

Equipment for Making Braille Labels

There are three kinds of brailling equipment, any of which could be used to make braille labels. Braille writing machines are somewhat like typewriters in that they emboss braille onto sheets of paper inserted into the machine when the appropriate keys are depressed.

Braille slates, however, are less mechanized and more portable. Modern braille slates, whether desk or pocket size models, consist of two metal or plastic plates hinged together to permit a sheet of paper to be inserted and held to receive the braille dots. The top plate is pierced with little windows; the bottom plate is dented with shallow pits. When a sheet of paper or piece of tape is between the two plates, a stylus fits through the windows of the top plate and presses the material into the shallow pits of the bottom plate to form the raised dots of the braille character. Each type of slate is designed to emboss a specific number of braille cells in a horizontal line and to make a certain number of these lines at a time.



A third kind of brailling apparatus is the braille labeling gun, which will emboss braille only on lengths of vinyl tape.

In her work at The Carroll Center, rehabilitation teacher Keri Frey has compared the available equipment potentially useful in making braille labels. Ms. Frey has observed that although the braille writer can be used for brailling some kinds of labeling materials, it cannot be used for embossing vinyl tape for labels, often the most practical material. The slate and stylus, on the other hand, is more frequently used for brailling embossing tape because it is less expensive than a labeling gun and more portable.

Using A Braille Slate to Make Labels

Kery Frey suggests the following procedure for making braille labels from embossing tape with a braille slate and stylus.

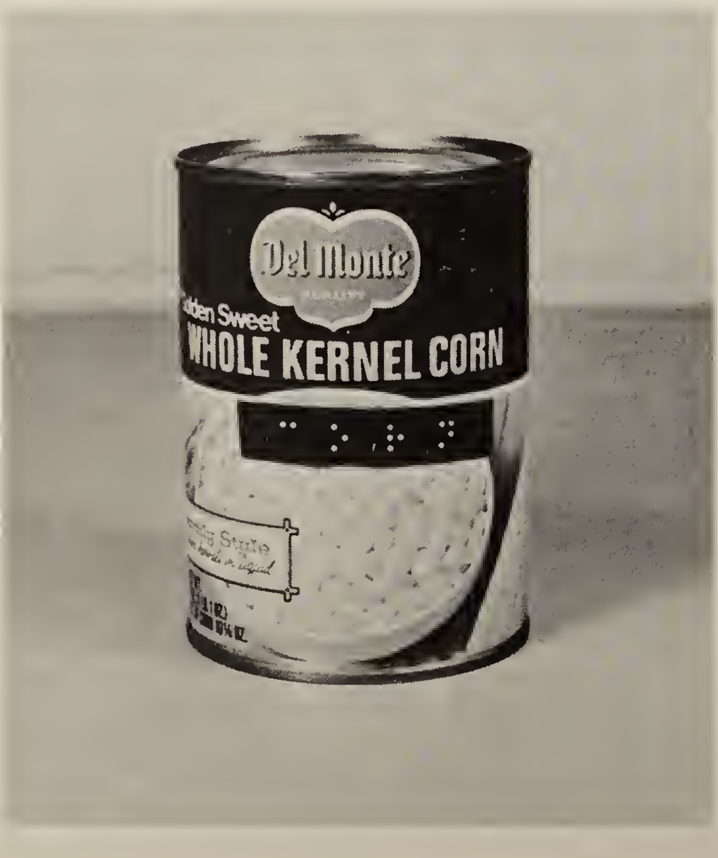
First, make sure the tape used is the kind which is one half inch wide. If it is narrower, dots will not fit on the tape, and if wider, the tape will not fit the slate. Then, make sure the slate to be used has labeling slots. (Some slates do not have them.) The slots are located on each end of the slate, before and after the second row of braille cells.

To identify the side of the tape to be brailled, particularly when embossing clear tape, place the roll of tape on a flat surface. The side facing the *outside* of the roll is the side where the braille dots will come through.

Now, open the slate slightly and feed the tape through the two slots so that the tape goes in the left slot and out the right slot. Remember, the braille dots will come out on the opposite side of the tape that you braille on, so the "good" side of the tape must face *down* in the slate.

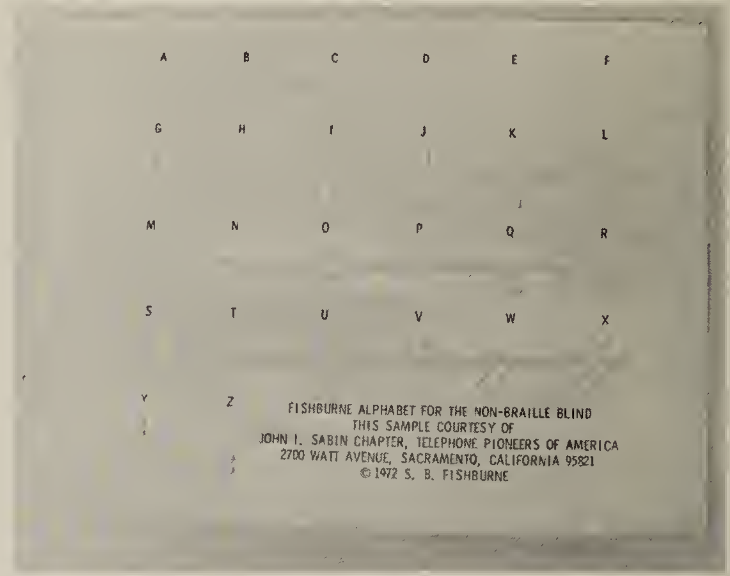
Make a continuous strip of labels, but be sure to leave one or two spaces between labels to allow room for cutting them apart with scissors.

Braille dots may be erased, but it is extremely difficult to erase plastic tapes. If you must erase a dot, take the braille eraser and place over the dot. Then press hard. If properly lined up, the dot will have been pressed back.



THE FISHBURNE ALPHABET ON LABELS

Proven useful for people who have difficulty feeling braille characters, the Fishburne Alphabet has been found to be an effective medium for alternative labels. Somewhat like braille, the Fishburne Alphabet uses specific patterns of embossed dots and lines to signal the individual letters of the visual alphabet. In their specific patterns, the embossed dots and lines are arranged in a manner that relates them to an imaginary axis. On this sample sheet, the mid-line axis is actually raised.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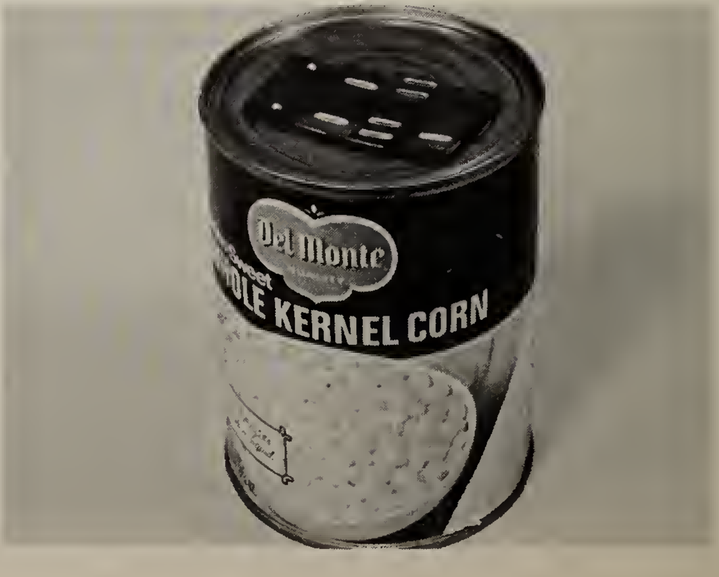
Like braille, the Fishburne Alphabet can transcribe a printed word, letter for letter, into tactile form. The length of the lines and the thickness of all the characters make them easily felt and read, and therefore people with severe neuropathy have found them useful. Like braille, this alphabet can be embossed on embossing tape of various kinds for versatile alternative labels.

However, the Fishburne Alphabet is more limited than braille in the capacity of conveying a great deal of information in a relatively small space. First of all, Fishburne characters are about twice the size of the braille letter space. Then, each Fishburne Alphabet character must be formed on an individual label, and word labels are therefore formed by applying separate letters side by side. Fishburne labels, obviously, can take up a great deal of space.



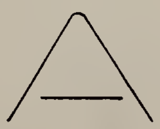
Yet, like braille, characters of the Fishburne Alphabet can be used as tactile symbols in an identifying code to save space. The character for "A" might be assigned the meaning canned fruit to emboss magnetic tape and attach to all cans of that food line; then, only one additional letter for each can—such as the character for "O," to indicate oranges, or the "P," to indicate pineapples—need be embossed and attached.

For people who do not read braille, the Fishburne Alphabet can be especially useful because it can be self-taught by using programmed cassette tapes provided by the distributor. (See Resource Guide.)

EMBOSSED LETTERS AS LABELS

The effectiveness of tactual graphics for daily use can be a matter of controversy. Still, for people who do not read braille, embossed letters can serve as labels. Enlarged and raised from a paper or plastic background material, embossed letters can be recognized and deciphered through touch. But to be most effective, to be clearly decipherable through touch, embossed letters must be not only raised and enlarged but must also have a configuration and size appropriate to the sense of touch. Embossed letters of any design and size are palpable; that is, they can be felt as objects. For example, the embossed letters that print a name on a credit card can be felt as a rough, raised line. Yet just because letters are palpable does not mean they are decipherable; although the rough, raised line of letters on a credit card can be felt, the letters *individually* are probably indecipherable through touch. In short, embossing letters will make them palpable, but embossing alone will not necessarily make letters tactually legible.

Thus, to make embossed letters legible tactually, the perceptual capacities and limitations of touch must govern their design. In fact, the rules of design that govern vivid tactile letters are frequently opposite to those for vivid visual letters. For instance, a wide-line letter (called *bold* in printer's jargon) is visually striking and arresting. Embossed, however, it is tactually blah, in fact practically indecipherable. Conversely, fineline letters are visually classifed as light print but embossed they make the sharpest, boldest impression tactually, just short of cutting like a knife blade.



The special capacities of touch can recognize the shape of an embossed letter in one of two ways: tactually or kinesthetically. *Tactually*, the 'retnoid' capacity of the skin's tactual sensors in the fingertips registers the contour of a letter and discerns the spatial relationships of its features; touch thus detects a letter's shape.

Kinesthetically, a letter is recognized when the finger or arm traces the shape of its embossed lines, and the shape of the motion of the finger or arm movement is discerned. (For an illustration, trace an imaginary "C" in the air, and then an "M." Notice how the two motions feel different.)

The nature of tactual or kinesthetic perception must influence the design of tactile letters just as the powers and limitations of sight have shaped the configuration of letters and characters in all written languages for visual perception. In extensive classroom experimentation and observation Robert Amendola of The Carroll Center has arrived at the following design characteristics and dimensions for tactile versions of letters from the visual Roman alphabet. If visual print is converted to tactile letters for use in labeling, then such specifications would ideally direct the design of the letters, since these specifications take into account the special nature of tactual and kinesthetic perception. To be decipherable either tactually or kinesthetically, embossed letters would optimally have the following characteristics:

Size
— height and width ½ inch for tactual perception;
— height and width ⅝ inch for kinesthetic perception.

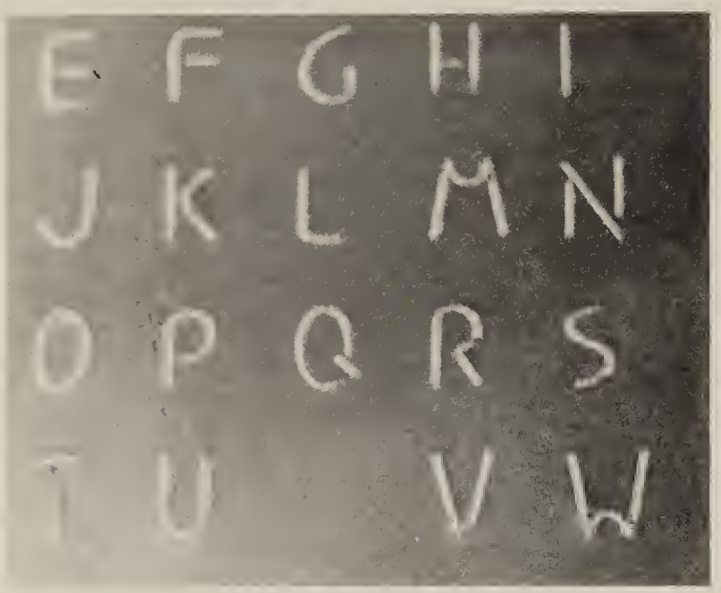
Configuration
— *thin lines:* only the width of a medium ball-point pen stroke;
— height of embossing not less than .025 inch or more than .030 inch, since the flesh of the fingertip needs to stay in contact with the background as it moves over the letter's embossed lines;
— *no sharp corners* and *no sharp intersections*, as in A, F or M;
— *slightly rounded corners*, which will allow the fingertip to move smoothly and continuously, aiding perception of the letter shape as well as the orientation of the overall letter;
— *slight breaks (possibly 3/32 inch) at the intersection* of all dominant letter lines with minor features such as the meeting of the crossbar in the "A" with the sides of its major triangle. (Such a small gap alerts the finger to the presence of a minor feature without arresting the finger's movement. Without this gap, the fingertip can lock in the triangle of the "A" so that it perceives only a triangle and thus ignores the remaining legs of the "A.")

Separation between letters
— sufficient to allow the finger to distinguish the shape of the letter from the shape of the space between a letter and its neighbor.

Respecting these designs and considerations enables the fingertip, hand, or arm motion to track the letter with clarity and a minimum of confusion. Although not all of the letters and kits listed below conform to these specifications for embossed letters set out above, we offer them with our specific evaluations respecting their uses in labeling.

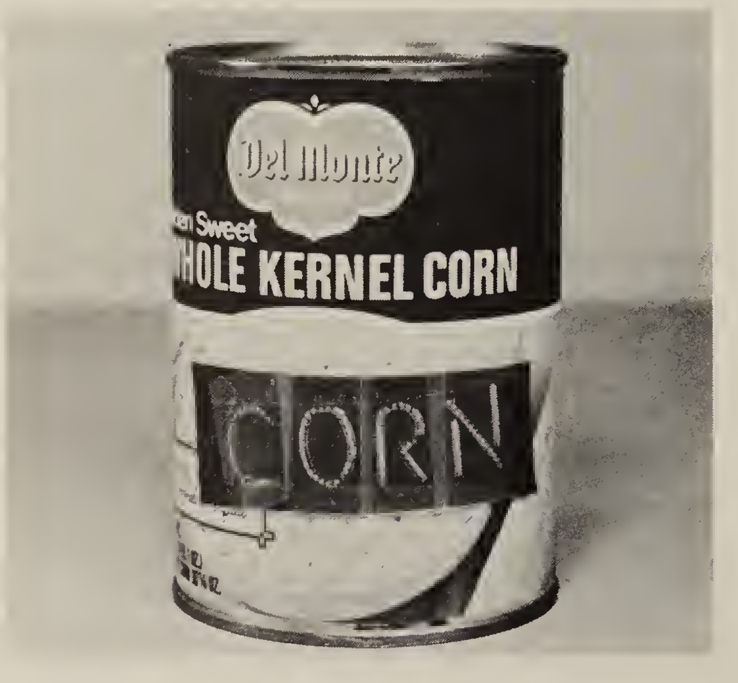
Gilligan Tactile Label-maker is new to the market and provides a means for making embossed labels of *ideal* specifications. For persons who do not read braille, this label-maker provides a means of embossing the familiar visual alphabet into a size and configuration styled specifically for optimum tactile legibility.

The kit contains a template engraved with all the letters of the visual alphabet (each conforming to ideal principles of design), a braille stylus, and 10 sheets of plastic made especially for embossing and for durability and tactility. It is also washable.



A sample of letters made with the Gilligan template.

The labels are formed by placing the translucent plastic sheet on the template and tracing the desired letter on the template with the embossing stylus. A person with sight must emboss the letters on the plastic.



Telephone Pioneer's Thermoformed Letters: two sets of raised-line or emobssed thermoformed sheets come from the Telephone Pioneers of America. One set has letters which may be cut from the sheet for attachment to magnetic backing or adhesive backing or with an elastic fastener. The other set has thermoformed words such as "corn," "beans," etc.

Two different types of master letters were used for these sets. In the letter set, highly-raised, sharp-ridged forms provide clear tactile information. However, in the word set, rounded letters were used and have been found to collapse with heavy use. This is a community service and is free to the individual, unless large quantities are needed. In that case, they are provided at cost.

Plastic letters, ready-made in large capitals, are also available from the Loeb Foundation and from Independent Living Aids; they have elastic bands or magnets for attachment and can be used singly as initials for the product or in pairs or sets to form a code to identify selected items. Used as a single identifying letter, for instance, the plastic "T" could attach to a can to indicate the tomato soup contained. Commonly sold as educational toys, such large capital plastic letters are available with magnets alone from Playskool.

LOW VISION LABELS

Labels to be read by individuals who have a visual impairment with some type and amount of remaining vision will, of course, be designed in accordance with the particular type and amount of remaining vision. Some readers with low vision can perceive colors, while others cannot. For some individuals, effective vision is limited to a small central field. In many cases, individuals have a reduced ability to perceive details; therefore, for them, making information or words larger and giving a greater contrast with the background can allow recognition. Just as in labels designed for tactile recognition (pages to), labels for people with low vision can either transcribe information into legible letters—new, simple forms having greater clarity of line and spacing with effective contrast and often a larger size—or labels can interpret the original words into a symbol or code legible to the individual with low vision.

With low vision, one might also identify a product by the shape of the words on existing labels or by the label layout. For example, many individuals with some remaining vision can tell Campbell's soups from other soups because of the familiar red and white labels. Also, when one is familiar with the products on the pantry shelves, he or she may be able to distinguish between the shape of the print "Tomato" and "Chicken with Rice."

Equipment for Low Vision Labels

Marking pens can produce a word or symbol in print as large and as bold as needed and on a background with enough contrast for some individuals to see it. The amount of enlargement or magnification needed will vary for each person. Remember that spacing between letters, words, and sentences can either impair or enhance the label's legibility. Discerning the label itself can be made easier by making the label in sharp color contrast to the item marked. In making the large print, consider the width of the pen point, which can vary from a fine ball-point to a broad writing point such as a laundry marking pen. Although the very wide tip can produce bold, dark lettering, it can write clearly only a few letters in the limited space of a label.

In respect to the durability of the ink, ball-point ink, water-based ink in felt-tipped pens, permanent ink in felt-tipped pens, all have different advantages. Note that with time, the intensity of ink color from felt-tipped pens will fade, so it is important to know the shelf life of a particular type of marker. Different ink colors may be advantageous, depending on the particular vision loss involved and on the use of the label. But even if an intended color is highly visible to an individual low vision user, the intensity and tone of ink colors vary with different brands of markers. Experimentation with different brands of markers in the same preferred color is therefore essential.

Tape as Material for Low Vision Labels

Masking tape, *Labelon tape*, or even *gummed mailing tape* can be printed on in large-print letters and can then be affixed directly to an item. The "Write-on-Label" tape dispenser, designed and distributed by 3M for labeling purposes specifically, has a 4½ inch long writing platform and is available from office supply stores.

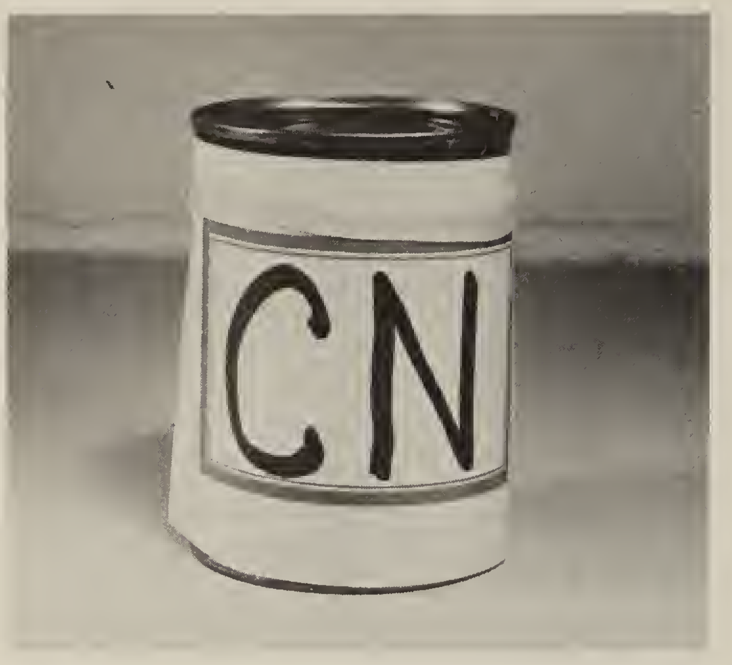
With most tape dispensers, like the Labelon dispenser, a firm, smooth writing surface must be provided for the tape.

Magnetic tape, which can be embossed in a large-print labeling gun, is available by roll. Because of its thinness and reduced adhering power, it may prove inadequate as a label even though it can be embossed with large-print letters; however, although *wide, heavy magnetic tape* cannot receive embossing, it can back vinyl tape printed in large letters. Or it can back adhesive labels embossed with large print to make reusable canned goods labels.

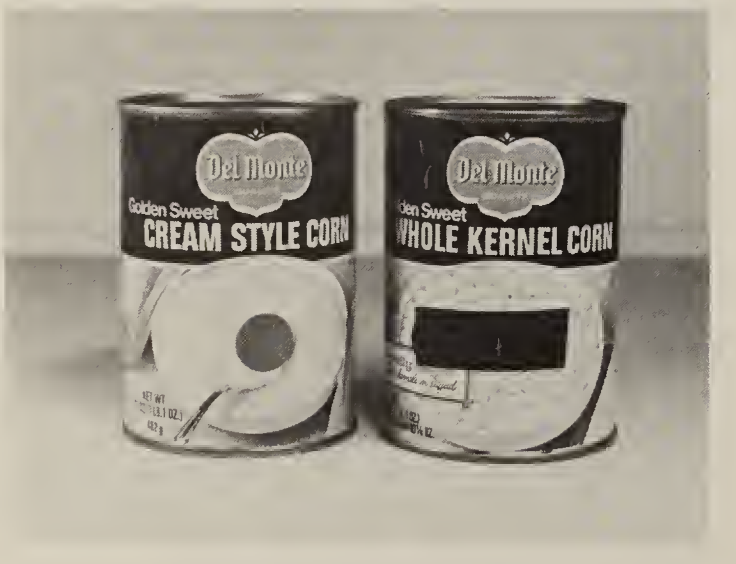
To emboss large print on *vinyl tape*, *labeling guns* are commercially available. The large print produced by the guns has the advantage of being large enough that the letters also serve tactually on a day when fatigue or poor light might diminish the usefulness of the residual vision. The tape for the large-print gun comes in many colors when ordered through a stationery store; it comes in limited colors when ordered from American Foundation for the Blind or from Independent Living Aids.

Use of Color in Low Vision Labels

Color, and contrast between colors, can serve as an identifying label since color can give a label unique visibility to individuals with some kind and amount of remaining vision. For persons with reduced ability to see detail, a heightening of color contrast can enhance the legibility of various large shapes. When the color of print or shape contrasts sharply with the color of the label's background, the label can become more readily legible: this simple principle can allow an individual to use even a color band to distinguish one product from a similar product. For example, colors might easily identify categories—red for canned fruits, green for vegetables—while embossed or affixed large print in a contrasting color could specify the item.

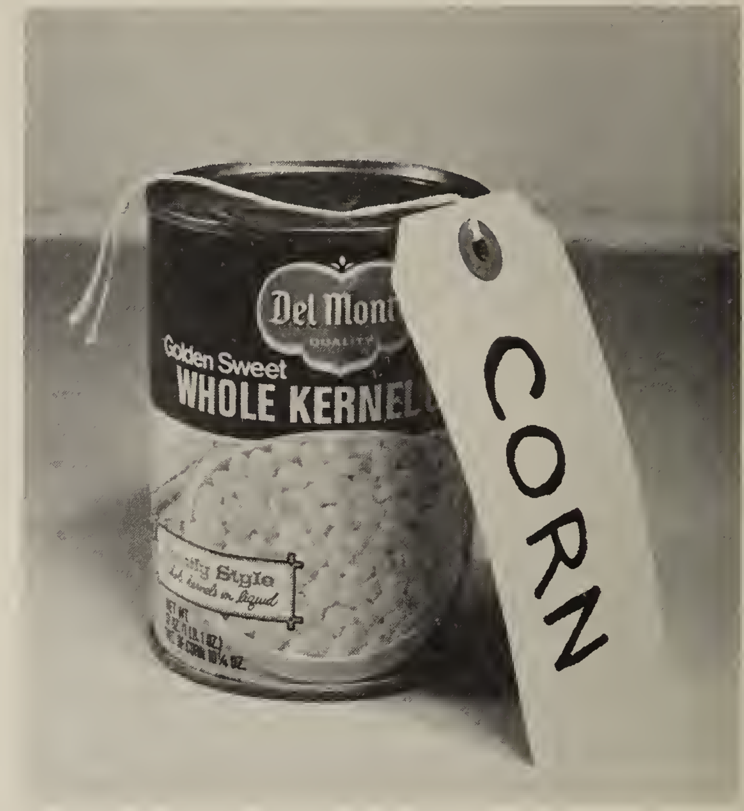


Fluorescent or *brightly colored labels* which are currently sold in stationery stores in all sizes, shapes, and hues may provide labeling signals. For many people, fluorescent colors are highly visible at a distance. These labels can be written on with a contrasting marker—in large print or large symbols or a combination of symbols to produce a code. A code, in fact, may be devised from the variously colored labels alone: *colored stickers* may be cut into the various geometric forms—circles, triangles, etc.—and each assigned a different identifying meaning.



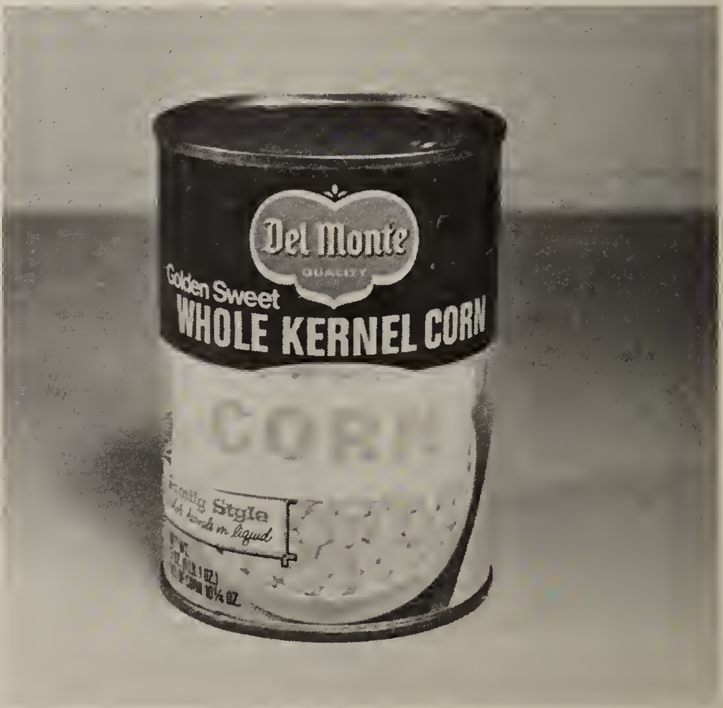
The person with low vision might read such a label both visually and tactually, since the distinguishing sticker shapes could be recognized through touch. Likewise, *masking tape, colored fabric tape*, or *black electrical tape* can form a symbol or code—such as a large black "T" for tomatoes. To achieve contrast on colored backgrounds, use *opaque white correction fluid* or *white ink*.

To achieve contrast without the use of color, consider the use of black and white materials together in labels. For example, *white masking tape* and *white freezer paper* (specially treated for durability) are good backgrounds for black large print. Providing a white border around the black large print will make the label more legible.



One may also put *black tape letters* on *white masking tape background* for greater contrast.

Self-adhesive letters, sold in art supply stores, are made of vinyl in white, black, bright fluorescent colors for sign making. These self-adhesive letters come in a variety of sizes. Remember that the backing chosen should provide the highest contrast possible.



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Many tactile systems, or components of those systems, in combination with features of large print or low vision labels, may prove appropriate for low vision users, so be certain to check earlier sections of this issue for other potentially useful kinds of alternative labels.

AUDIBLE LABELS

Recording on tape is the most common method of storing and retrieving speech, but in the past it has not proven the best process for making so-called audible labels. None of the common recording methods—cassette, open reel, 8-track—has proven practical for labeling purposes. Conventional reels or even tape cassettes have too much tape on them, more tape than the concise message of a useful label needs, and both reels of tape and cassettes are obviously too cumbersome to be attached to small items needing labels.

Yet there is another method for recording and playing short spoken messages, a method which provides a recorded message in a size convenient for labeling. Coming from the field of education, this system, utilizing a card reader, is designed to play a message stored electronically on talk cards, the size of index cards, which have a narrow strip of recording tape on one or both of the horizontal edges. When used in teaching, such cards carry visual images, as well as the recorded information; inserted into the small portable card reader, the card "speaks," identifying or spelling the object pictured on it. Most significantly, though, card readers in some models can record messages as well as play recorded messages. These models can conveniently make audible labels in practical sizes.

In particular, the Voxcom Mark II Card Reader has proven versatile and useful for making audible labels. The system works much like a conventional cassette tape recorder. First, the card reader adapter snaps into the Voxcom card/cassette recorder, much as a cassette tape cartridge fits into a cassette recorder. The talk card, with its strips of recording tape, slips into the card reader adapter, ready to receive the spoken message. To record, one simply presses the record and play buttons simultaneously, slides the talk card into the card reader adapter, and speaks into the machine's built-in microphone. Providing about one minute of play time, the card may be cut to fit a particular item such as a medicine bottle or a soup can; with its recorded message the talk card becomes a label to be heard when detached from the item and played on the portable card reader.

Any space left unrecorded can receive additional information later. Like conventional recording tape, these cards are erasable, so they can be re-used for new labels and different messages.

The electronic recording tape used on talk cards can be bought separately rolled on spools much like any adhesive tape. Such paper items as checks, bills, and receipts can receive strips of the adhesive recording tape, and then the item itself can slip into the card reader to record and later play back important details such as a check's amount and payee or even the name and telephone number on a business card one wants to remember. Likewise, a plastic credit card can receive the tape to record pertinent information.

Other specific labeling uses include attaching a talk card to the outside of file folders. The talk card can list in detail the contents of the folder. Attached to food items, such as a package of cake mix, the talk card could identify not only the contents but also give some instructions for mixing and baking. Talk cards can identify the style and color of garments, and a talk card slipped into a pocket on a record jacket can name the tunes therein.

Audible labels can, clearly, attach to almost any item needing to be identified, and short spoken messages on talk cards have also proven useful for purposes beyond labeling:

To give and receive short personnel messages among family members at home; to take notes from a telephone conversation—the system may be used with a telephone pickup; to record banking transactions on checks, bank statements, in ledgers; to store important numbers such as credit card numbers, insurance policy numbers, etc., either on recording tape placed on the documents themselves or on index cards filed together; to record memos in the office or information at work in such activities as inventory control—because the talk card can also receive type or writing, it is then useful to both sighted and visually impaired workers.

On a file of talk cards, or on a talk card as a label, other kinds of signals—large print, braille, or notches—can help in quickly identifying an item. Then the talk card can provide its spoken message with its more detailed, or clarifying information.

ALTERNATIVE LABELING IN MANAGEMENT OF CANNED GOODS AND HOUSEHOLD SUPPLIES

Gladys Loeb, a visually impaired homemaker, has investigated and developed systems of labeling which work for her in managing food and household supplies. In her article, "Braille Labeling and Managing Food and Supplies for the Blind Homemaker," Mrs. Loeb presents an imaginative and comprehensive system for nonvisual labeling of food supplies in the kitchen. While most of Mrs. Loeb's suggestions specifically involve the use of braille labels, her hints for labeling procedures and her creative management system can apply as well to other kinds of nonvisual or low vision labels. Mrs. Loeb's original article describes her use of many of the labeling materials evaluated earlier in this issue—half-inch embossing tape, Brailon (thermoform) plastic, Brailabel sheets, magnetic tape; here, with Mrs. Loeb's generous permission, we excerpt only her unique suggestions for materials and techniques for nonvisual labeling.

To her readers Mrs. Loeb says,

> "There is no *one* material or technique that covers every labeling need. Each homemaker may elect to use some or all of the methods described here, and even invent some of her own. A variety in labels 'spices one's memory.'"

We hope that Mrs. Loeb's recommendations can serve not only as a pattern to follow but also as a stimulus to creating individually suitable systems for alternative labeling.

ORGANIZATION AS IDENTIFICATION

Surprisingly, the first principle in devising a nonvisual system for household management involves not designing nonvisual labels per se but rather in creating good organization. Good organization in storing canned and packaged goods—a place for everything and everything in its place—will significantly cut down your need for labeling.

Identification by *Placement in Cabinets:* In storing canned goods such as fruits, vegetables and soups, I reserve a shelf or section of it for each general line. I place the line of food most used (soups, in my case) in the most convenient-to-reach location and arrange the remaining cans in alphabetical order according to their contents.

The addition of stack shelves inside the cabinets allows for better separation of different items. These can be purchased at most department or hardware stores, or they can be custom made to better suit your needs. Condiments can be organized in several different ways: according to frequency of use, in alphabetical order, or into categories such as those used in main dishes (garlic salt, celery seed, etc.). Some may be grouped together in spice racks or in plastic berry boxes for a more orderly arrangement.

A note here about dividers in the cabinet—the shelves can be effectively sectioned off with sturdy plastic soda straws laid horizontally and glued, tacked or taped into position. If you wish something more permanent, use strips of wood or dowels. Glued upright on edges or ends, flat tie boxes or gift boxes make section dividers, or you can position items easily recognized by touch (such as ketchup bottles or mayonnaise jars) as dividers.

Rubber bands can mark items and thus supplement identification by placement on the shelves. I place one band on my favorite can of soup, for example, two bands on the next favorite, and so on. You can repeat this with your canned vegetables and canned fruits as long as you store the food lines in separate shelves. After three rubber bands, I resort to other labeling techniques.

Identification by *Placement on Door and Wall Shelves*: Addition of extra shelving just wide enough to accommodate one row of canned, bottled or packaged goods of various heights saves much searching and confusion in the back of deep wall cabinets. These shelves can be installed on any convenient wall in the kitchen or basement, on the back of a door, the wall of a stairway, in a closet or pantry. Sectioning off certain areas on these shelves—the soda straws work fine here—and attaching labels to the shelf edge of these areas helps in stocking and in checking your supply. Labeling the shelf edge further reduces the need for labeling each item individually.

Identification by *Association in Drawers*: Normally canned goods are not stored in drawers. However, I slip cans of tuna and tomato paste in separate and specific places in my kitchen's non-food storage spaces such as towel drawers. You can remember where they are stored by practicing the use of association—for example, tuna, tomato paste and towels. You can make up your own catchy association devices to stimulate the memory. Drawers used for this purpose can be divided with as many sections as you find necessary for retaining articles in their proper places. A variety of plastic trays and adjustable drawer dividers is available in hardware or department stores, or can be custom-made like the stack shelves.

Identification by *Grouping in Plastic Bags:* A practical method of reducing the need for extra labels is to place several identical items in see-through plastic bags. (This can be done right at the grocery store.) One label stapled, taped or clipped onto the bag or secured to one item in the group eliminates the need for individual marking. This method provides an orderly togetherness from the store shelf to the home. It is ideal for packages of frozen foods, meats and bagged vegetables for the freezer, and for storing a supply of canned or packaged foods in your cabinets. Another method, one that works well in grouping small "feel alike" containers such as puddings and gelatins, is to stretch the elastic of one braille label around several boxes of identical flavor.

MATERIALS FOR BRAILLE LABELS

Flat plastic: While labeling supplies are available for sale, I do not find it necessary to purchase any of my flat plastic for brailling nonvisual labels. I have used everything from scraps of cardboard held on with a rubber band, to my new, sophisticated magnetic materials. "It may *seem* to be a simple matter to make a braille label," but a few unfortunate experiences in the early days quickly convinced me that "there has to be a better way of doing this." For example, I started using cardboard file cards, but found that the dampness of the refrigerator and freezer softened the dots and rendered the cards impractical. I then began brailling onto thin plastic which gave me a firm, easily read dot on a label that was durable and reusable.

Some of the label materials that I use derive from common packaging and other household articles such as the plastic-coated butter, margerine or milk cartons; discarded plastic greeting cards; plastic snap-on lids; and plastic covers from greeting card boxes and product display cartons. These may be opaque or transparent, but transparent material is necessary for use in twin-vision labels. Using material at hand not only helped my budget, but like most homemakers, I enjoyed making use of discarded items.

Before considering a piece of plastic for labels, test it for brittleness. Fold a corner, and if it doesn't break, it is acceptable for use as a label. Certain kinds of plastic provide a firmer dot than others. If you require more plastic than that readily found, advertise your needs to friends and neighbors. They will be more than happy to save plastic for you. Friends working in stores, doctors' offices or other places of business can be chief sources for transparent plastic.

Snap-on plastic lids: These opaque, plastic can covers have a number of practical uses. When provided with a brailled embossing tape, they can snap onto the top of a can and serve as a label; they are reusable, cans are easily stacked, lids are neatly fileable (no entanglement of fasteners) and are attractive in appearance. For orientation in reading, I place my tape labels off-center within the flat portion of the lid. These plastic lids, designed to snap back onto opened cans of certain products fit other popular sized cans:

> Hershey's Syrup lids fit onto 15 oz. cans of kidney beans, cherries, etc.
> Planter's Peanut can lids fit onto the flat 6½ oz. seafood cans, etc.

Awake lids fit most soup cans, as well as potted meat. Coffee can lids (1 lb. size) fit a 2½ lb. can.

Flat Plastic Clips: These are usually found in the produce department for plastic bag closures and on bags for bread and other bakery goods. They are too firm to be brailled, but are ideal for making labels which receive brailled embossing tape.

TWIN-VISION LABELS

This is a neat label for a marking and shopping system for the blind homemaker and her sighted helpers. A label identified in print as well as braille provides instant recognition of the label by the sighted. This is useful in many ways. For example, as the items are used, the homemaker removes the twin-vision label and files those that require replacement as the "shopping list." The sighted shopper uses these as a list to buy the individual items. As the article is selected from the store shelf it is promptly labeled. (One less on your list too!) When the groceries are delivered to her, the homemaker unpacks and stores them—no further identifications required!

A variety of twin-vision labels can be made:

1) The *magnetic sheet material* has certain advantages. It is inconspicuous, not bulky, and attaches magnetically to most canned goods. To use it for a twin-vision label, I prefer to braille it first, then place the print just beneath the braille. This reduces the length of the label. But braille may also go directly over the printing if it leaves the print legible to the sighted helpers.

2) The flat plastic clips found on bags for bread serve as unique and dainty twin vision dual-purpose labels. They are too firm to be brailled and therefore are used with embossing tape—braille tape on one side and print on the other. (An inexpensive embossing tool for printing is available in most stores, or you can improvise there with paper, pen and tape.) You will note that space on these clips is at a minimum and you must therefore contract your label accordingly.

The opening in the clip should be left free to clip onto the rings of a looseleaf notebook or onto a drapery ring. I arrange them in alphabetical order on the ring as I make up my "list" for shopping. These are ideal as a closure and label for plastic bags (usually provided at the produce counter) containing identical items such as frozen peas, or canned goods.

3) It is possible to make twin-vision labels with *Brailabel sheets* in several different ways. The soft plastic back can be peeled off, the message written on it, and then the backing can be pressed again onto the Brailabel. This prevents the message from smudging. Another idea that I experimented with recently is to use the cut-out word—such as "tomato"—from a can label. Sandwich this between the two transparent plastic layers, braille the plastic layers, and the whole thing makes a wonderful twin-vision label! (Of course, I need a sighted person to do the cutting.) The message can also be written on any firm paper and the brailled adhesive-backed transparent Brailabel plastic sheet applied over it.

4) *Flat transparent plastic material* has certain desirable features. Brailling onto transparent plastic, and then printing or typing the same message on a card and securing the two together with an elastic band fastener makes a versatile twin-vision label.

For the benefit of sighted family members who may be selecting something off the shelf, the braille label should be placed on the back of the can or jar so that it does not cover the printed label. (You may wonder how I know which is the back side—well, I can tell by feeling the paper seam of the can label.)

Tools for Making Braille Labels

A kit of basic tools and materials at your fingertips will save searching and will simplify the task of label making. I find the following items useful:

Long-bladed shears for making straighter cuts;
Pinking shears for label orientation marking;
Meat skewer, paper punch, or awl for piercing holes;
Stapler for attaching labels to bags;
Patterns for label outline and coding;
Ball point pen, paper clips, or *bullgod clips* and *file cards* for making twin-vision labels;
Elastic band fasteners for attaching the labels;
Rubber bands (heavy quality) as a substitute for elastic fasteners.

ADDITIONAL TIPS

Marking for Label Orientation: Probably the most important suggestion I can make is to recommend that you identify the top or end of your label. How many times have you picked up a brailled article and had to read and re-orient it before you found the leading cell? I save time and frustration by pinking the top edge or right hand edge of my labels, so that instantly I know where to start reading. One wonders why *all material* for brailling isn't premarked for orientation.

Contraction Tips: To reduce the number of braille symbols on your label to a minimum and retain identity, I use variations in my contractions. Perhaps this is against the "golden rule" of deleting vowels, but I find that the practice of individual logic may serve your memory best. For example, I eliminate all of the plurals and some of the vowels. For "tomatoes," I use TOMA instead of TMT, and for "spinach," I use SPIN instead of SPCH. I suggest that the individual select and personalize her own contractions.

Fastener Tips: To attach labels I use elastic band fasteners, the kind used for halloween masks. I have found that they are excellent for attaching labels. The steel barbed ends are perfect for securing the band to the label. The 12-inch length allows the band to encircle larger items once, and most others twice. I used to raid our local variety stores around Halloween time to get a year's supply of these fasteners, but now I have a source of supply and will resell them to those who otherwise cannot obtain them.

To attach the elastic band fastener to a label, use your pattern for locating the holes (the pattern you use to cut your label to size and shape will also have the appropriate holes punched in it). You can use a paper punch, although I prefer a meat skewer because I find it easier to guide. Push the barb tips of the elastic fastener through the pierced hole from the back side of the label. This allows better access to the label for reading.

Reusable Labels: Make labels that you can use again and again. This is the most practical, time-saving, and economical method in the long run. True, it also involves filing the labels away for reuse, but it is less time-consuming than brailling a new label each time it is needed.

Snap-on lids provided with brailled embossing tape are, of course, reusable; so are labels made on magnetic tape. On some containers with screw-on lids—such as jars of spices, bouillon, or dressings—your marked lid can be transferred from the empty to the newly replaced item. (An exception to making reusable labels might be made in the case of spices or other items which are only used a little at a time. For them, I use a brailled embossing tape which is discarded with the container when empty.)

To file these reusable labels, after much trial and error, I have developed what I consider to be a most efficient system of filing brailled labels for reuse. I attempt to provide a receptacle for each kind of label (in respect to food line) at the place of usage. For example, I place a receptacle on the canned fruit shelf for the canned fruit coded labels.

For the utmost in convenience, I also designed a "door caddy" as a receptacle for labels (and small food packets as well). The door caddy is like a shoe bag, but with shallower pockets. Small trimmed-down plastic bags thumb-tacked or taped to the inside of the cabinet door may also be used as receptacles, for labels to be reused.

While removing the elastic banded label after its use, twist the band like a rope and wrap it around the right hand end of the label. This will reduce tangling and keep the important first braille symbols exposed for quick identification in sorting and filing. I then drop the labels into their respective places and set aside those required in my shopping list.

Periodically, I collect and sort the accumulated labels and file them in hardcover, two-ring folders. The folders are 4 x 10½ inches, and are sold in most stationery, department, or drug stores as "Important Paper Files." Each file contains eight heavy-grade envelopes. Store the folders on end as books on a shelf and identify with a braille tape label on the exposed edge. Then each envelope within a file is alphabetically indexed to cover each food grouping. That is, files by food line, and specific foods by alphabetical arrangement in each file. Additional smaller envelopes within the large ones give more flexibility to this system. The homemaker's food preferences will dictate her own file categories.

Users of the new magnetic labels may want to use the system described above, or they may file them inside a metal cabinet door, on the outside of the refrigerator or freezer, on a metal strip applied to the front edge of a wood shelf, or on a metal bulletin board. It is a good idea to file these alphabetically; it takes only a minute and saves much time later.

If you find label-making is a chore, why not have a label-making party with your friends and other homemakers? You can share tools and ideas and have fun! We did!

Although we have covered many ways and means of marking our food containers for identification, I still allow for a slipup along the way. You guessed it! Always check the contents after opening—by the old reliable smell, touch or taste test.

—*Excerpted from "Braille Labeling and Managing Food and Supplies for the Blind Homemaker," by Mrs. Gladys E. Loeb.*

LABELING AND ORGANIZATION IN MANAGEMENT OF PERSONAL AND HOUSEHOLD TASKS

INTRODUCTION

The following section addresses specifically the application of alternative labeling in managing personal business, household bills and documents, belongings and household equipment and tasks. Yet we would emphasize that methods for managing household matters can readily be adapted to a work setting; alternative labeling systems in the household can well serve as models for storing and retrieving the information and equipment related to one's vocation.

All the following systems for personal and household management were authored by Nancy Campbell, rehabilitation teacher at The Carroll Center. Ms. Campbell teaches the use of these systems to people with varying degrees and kinds of visual impairment.

MANAGING BILLS AND DOCUMENTS

Even within a supportive family, independent living is still important to a person with vision loss. Maintaining access to personal records of finances, of essential documents, and of possessions can give the person control over his or her life, and this control can contribute to a firmer sense of independence and confidence. By enabling the person to store and retrieve essential information, nonvisual labeling or low vision labeling procedures can provide the means to keep such records. Significantly, alternative labeling also makes possible the use of these records in carrying out financial transactions—personal banking and bill paying. Thus, a person can retain concrete control over this particular life-sustaining activity.

Worked out by individuals with vision loss, such totally independent procedures for household record-keeping consist of thoroughly organized labeling and storage systems. Though in many cases a person with sight must first secure certain kinds of information, a careful and thoroughly planned procedure of organization will diminish the need for the sighted help.

Below we discuss in detail the use of alternative labeling techniques and organizational skills in tasks related to paying household bills; managing bills can serve as a model for carrying out other kinds of personal and professional business. For clarity, we divide the process into five steps:

1. Gathering and Keeping Billing Information
2. Paying the Bill
3. Recording the Payment
4. Mailing the Payment
5. Filing Paid Bills and Cancelled Checks

Obviously, the process of managing bills does not always follow these five steps easily. In any one transaction, one might actually carry out some of the outlined steps almost simultaneously.

Gathering and Keeping Billing Information

When the mail is received, it should first be sorted into bills and personal mail. Personal mail may often be recognized as feeling different from a billing envelope. That is, a personal letter will frequently feel fatter than the thin, crisp-edged envelope from the electric or telephone company. The bill envelope may also have a cellophane address window easily recognized by touch.

If a family member or a reader assists with reading mail, the visually impaired person might consider coming to the session prepared with a tape recorder and at least two empty cassettes to record and thus store the readings for retrieval later. Nonvisual labels should mark the cassettes with one marked "personal mail" and the other prelabeled with the month and year as in "November 1981 Bills." Such records may, of course, also be kept and labeled by braille, large print, or by any other practical alternative label.

Along with amount due, a braille, large print, or taped account might record the following full billing information:

1. Company name
2. Account number
3. Amount due
4. Past due amount and/or late charges
5. Due date
6. Address and telephone number
7. Name of contact person at that company

The visually impaired person does not have to rely on the post office alone to deliver the bill; he or she may obtain the billing information monthly by phoning the utility company (or other routine sources of bills) and by requesting the current status of credit or balance due. The information can then be spoken into a cassette tape recorder and recorded on the prelabeled cassette for retrieval later. (Or indeed, the information can be recorded and labeled by any other method suitable to the person.)

Paying the Bill

Once the amount due on an account is known, the bill can be paid by one of the following methods:

1. By cash, in person, at the bill paying center, in which case a receipt must be obtained;
2. By check when the person writes it out using a check guide for handwriting (see AAR #3) or a large-print check or a raised-line check embossed with its own guides for placement of payee, amount and signature;
3. By money order obtained from and made out by the bank or post office;
4. By bank check obtained from the bank;
5. By the Pay-by-Phone method now available at many banks.

Recording the Payment

If the bill has been paid by the Pay-by-Phone method, the phone conversation itself may be taped to record the transaction. Otherwise, information from a personal check, money order, or bank check may be recorded in any of several ways: it may be taped on a cassette file of such transactions; the check stub may be kept as a payment record; the cancelled check, when returned by the bank, can be filed; or the check stub information may be kept in a ledger form in braille or large print.

If the person has chosen to use the cancelled check as the record of payment, he or she can braille the check with essential information before mailing it out. The check itself may be brailled across the top without interfering with the bank process as long as the braille clears completely the printed information. Information may be as little as check number, or may include amount, initials of payee, date, or whatever abbreviation fits the space. However, durability of braille on check paper is not good for more than a few readings, so that it requires reinforcement. A strip of transparent tape across the back of the check insures that when the information is brailled, the dots will be sturdy. Wide transparent tape assures that the top line in the slate will make contact with tape and not paper. (Note that checks may be brailled on either a slate or a braille writer.)

Mailing the Payment

If the person has chosen to pay the bill by personal check, money order, or bank check, then the next step is to mail it. Basically, mailing the payment involves two tasks: obtaining the payee's address and addressing the envelope. To obtain the payee's address, the person may refer to the already established file of billing information. Or the person could well have set up one of the following files for both personal and business addresses.

To many individuals, a *tape-recorded address file on cassettes* proves useful. As in any filing system, addresses are arranged alphabetically according to the company or person's name. Cassette address files may be tone indexed at each change of letter, where the As end and the Bs begin, for instance; and blank space at the end of each letter must be left to receive new addresses. Or four-track recordings may receive additional addresses on tracks two and four. Addresses might well be added to the cassette file during a session when a sighted reader helps with correspondence. In addition to the address and phone number of the company, the entry might also include the account number and the name of a contact person at that company.

A *braille address file* can be set up easily as well. Cards brailled with address, phone number, account number, and name of contact person can be mounted in a rolodex system so that cards are never misplaced and are easily accessible. Filing them upside down and backwards allows a person who reads braille to read the card without removing it from the rolodex. The braille card may also be printed with the information so that sighted family members can also read it.

To address the envelope by hand, the person may find a hand-writing guide practical. (See AAR issue #3.)

Filing Bills and Cancelled Checks

To set up the file, first decide on major filing categories under which you will store bills and cancelled checks. For example, bills and checks may be filed by month; by topics such as utility, medical, clothing, etc., or Boston Gas, New England Telephone, Filene's; or by the separate categories related to divisions of the income tax form.

Once major categories are decided, they can be indicated by nonvisual or low vision labels on sections of an accordian file. Accordian files help insure that papers and checks stay securely inside their designated folders.

IDENTIFICATION OF CLOTHING

Just as managing one's own financial transactions contributes to maintaining personal independence, so too managing one's personal belongings is often psychologically essential even if not practically necessary. The following system for managing personal clothing consists of both labeling and organizing methods. In setting up a similar system, emphasize consistency and orderliness, and remember the maxim "a place for everything and everything in its place."

Organization of Clothing

In the bureau, have a definite place in each drawer for specific articles. Use shallow drawers for small items and deep drawers for bulky apparel such as sweaters, shirts, and so on. Use plastic bags, cardboard drawer dividers, or box covers to contain different categories of clothing. Place socks on the right side, underwear on the left; group similar clothing together in drawers, underwear on one side, shirts on the other.

In the closet, keep similar types of articles together: slacks, blouses, dresses, sports jackets, all suits, or arrange clothing categories, such as casual wear, work clothes, dress clothes, coats, jackets, and so on. Arrange so that frequently worn items are easily accessible, and use clothing bags, shoe bags and hat boxes to contain different types of garments. Hang matching shirts and slacks or matching skirts and shirts together on the same hanger.

Labeling of Clothing

The *material of a garment* can sometimes identify it sufficiently: make yourself familiar with the feel of various textures (wool, cotton, silk, knit). Or let *style and detail* identify it: three buttons vs. four; pointed collar vs. round; v-neck vs. turtle neck; sleeveless vs. three-quarter-length sleeves or full-length sleeves; pocket or no pocket or the pocket's unique location; cufflink holes, cuff buttons, or snaps.

Generally, only socks, ties, shirts, stockings and sweaters will have identical styles and details, so only they will require marking with a specially devised label. To distinguish garments identical in style but different in color, label by first choosing a specific location to which to attach the label. Of course, an inconspicuous place is best—such as on the wrong side of a skirt hem or inside or under a collar. It is important to be consistent and mark the same types of garments in the same location. Here are some suggestions: mark dresses and blouses on the facings; mark trousers and skirts on the inside waistbands; label shoes by marking forward side of heel near the sole, or outside of shoe with thumbtack or tape near the arch.

After the location for labeling is chosen, one or more of the following labeling options can be selected and put into use:

1. Aluminum clothing tags from AFB, ILA (free of charge).
2. French knots embroidered into the cloth (one knot for white, two for blue, and so on).
3. Aluminum tape can be brailled or cut into various shapes, each representing a different color. Cut the label small and rounded to prevent its catching on the cloth during dressing, then punch a small hole in either end. A needle and thread will pass through the holes to sew the label to the fabric.
4. Buttons—round, diamond-shaped, square—can by their shapes indicate different colors. Even a button's texture, size, or number of holes can indicate a specific color. Such identifying buttons may be sewn inconspicuously into a garment, or attached by the Buttonneer, a commercially available gun which attaches buttons with plastic tabs.
5. The particular shape of a sewn-in label can be memorized, or it can be cut in half. One can also cut the labels of identically styled clothing into different shapes, such as triangles, or squares.
6. Safety pins can be placed in a certain location and the direction of the pin's head can identify color: head up for blue, down for red. Various patterns of safety pins can also convey identifying information.
7. Hangers in various materials (wire, plastic or wood) and styles, can indicate the colors of the garments hung on them.
8. The fold of socks can indicate their color: roll the black ones, leave the brown socks flat when storing in the bureau drawer. (To keep sock pairs together in the wash, be sure to safety pin them or tuck them together when undressing.)
9. Common key tags can be brailled and pinned to ties to indicate their color and pattern, or a piece of cardboard bearing an identifying symbol can be placed around the tie when it is stored. (For example, pin a safety pin to it, or attach a cut-out shape to the cardboard.)
10. Alphabetize clothing according to color—black, blue, etc. (One must carefully keep track of these items when washing them in order to identify them properly when dried and returned to the closet.)
11. Hang belts on the same hanger as the pants, dress or skirt to which it belongs.
12. A coat marked with a safety pin or other symbol in the lapel, cuff, seam or collar, can be readily distinguished from other similar coats on a public rack. *This article on identifying clothing was brought to The Carroll Center curriculum files by a former personal management teacher; we regret that we are therefore unable to attribute authorship.*

LABELING PHONOGRAPH RECORDS

Even before labeling is considered by owners of a collection of phonograph records, a principal of organization should be devised. Classical, jazz, rock and roll—in short, kinds of music usually form the categories into which a personal record collection is sorted. Once sorted into categories, the records can be labeled, first according to category by an identifying sticker in a particular corner of the album cover or by a braille prefix on the cover indicating the category.

While the album cover usually bears a label indicating the title, the record itself also needs at least an abbreviated or coded title. Side one and side two need to be marked also, unless a title label is consistently attached to side one (or two) only. Labels on records must lie flat enough to allow the record to lie level and steady on the turntable. To indicate side one, a simple strip of masking tape works well.

One audiophile attempted to develop a labeling system with a Voxcom card for each of his records. This proved to be too cumbersome, so he eventually numbered each of his records after grouping them by categories. Thus, any record numbered one to ten was classical; ten to twenty indicated a jazz recording, and so on. A master list of all the records was written in braille. (Or such a list could be recorded on cassette, depending on the preference of the individual. Likewise, a master list could be alphabetically arranged, making it easy to locate "Beethoven's Fifth Symphony" under "B" and listed as #21, and that record could in turn be located as the twenty-first record on the shelf.)

For people with low vision, only side one of the record itself need be marked, since the record jacket colors or shape or outline of the cover illustration of a familiar album can be recognized.

LABELING CASSETTES

Cassettes of magnetic recording tape make good audible records—from recipes to address lists to the account numbers and amounts due for household bills. The user simply speaks the information into the tape recorder's microphone, and a permanent oral record results. But before a tape cassette can become so useful, the user must know certain specific information about the tape cassette itself: the length of the tape contained, its quality (kind) and which side is one and which two. Cassettes must thus themselves be marked with some kind of alternative label to convey that essential, identifying information.

To indicate the *tape's length*, notches may be cut in the plastic housing of the cassette—one for 30 minutes, two for 60 minutes, three for 90. Some tactile code should be devised to indicate the *kind of tape*—its bias and equalization for owners of super sensitive stereo equipment; whether it is made specifically for voice recording; whether it has two or four tracks. To distinguish *side one from side two*, the notches which indicate the tape length can be scratched consistently on side one, thereby making side two the unmarked side. Or some cassette producers screw the housing together with small screws on all four corners of side one only, so that the screw heads serve to indicate side one tactually.

An alternative label on the cassette itself should identify the category of its contents—music or billing information or recipes, etc. Tactile stickers—silk for music, sandpaper for bills, for example—can serve, or colored stickers can indicate various categories to people with low vision. For those who read braille, a brailled prefix on the cassette's label can indicate each category. But a separate storage location for each category of cassette can eliminate the need for coded labels entirely.

If you do decide to label cassettes instead of or in addition to storing them by category, the following specific suggestions for labels may prove useful.

1. If dymo tape (embossing tape) is used, care must be taken that the corners do not extend into the holes for the spindles.
2. To make a large-print label (for people with low vision) masking tape or commercially available labels provide an uncluttered surface on which to write. Care must be taken to leave the holes for spindles unobstructed.
3. Rubber bands in varying numbers can provide a temporary identification to distinguish categories.
4. As mentioned above, various textures or tactile shapes may give identifying information.
5. Index the various categories and individual tapes keyed by number on a sheet of paper in braille or large print.

To indicate specific contents of a tape within a major category, note the following suggestions. *Subsections can be located by index tone* if the recorder has that option: the fourth beep might indicate the fourth section, for instance. (Or a more complicated and specific morse code-type system can be devised.) *Subsections can be located by making a rough timing assessment* of the sections of tape; just count the seconds while the tape is in fast forward or rewind. Once the location of subsections is known in one of these ways, the *location can be indexed* on the first ten seconds of the tape—if that first ten seconds has been purposely left unrecorded to receive the indexing information as the user adds to the tape. Or a four-track tape recorder may provide the means of indexing by using tracks 2 and 4 for the titles of the subsections.

MANAGING HOUSEHOLD TASKS AND ITEMS

For a thorough presentation of labeling for managing food supplies, see Gladys Loeb's article on page above. Here we suggest ways to use alternative labeling techniques in managing other aspects of homemaking—the use of labels for kitchen equipment; labels for sewing supplies and equipment; and labels and organizational methods for access to items in the shop area.

Labels as Aids in Cooking

To mark *measuring equipment*, use notches, especially for durable plastics: cut into the handles of measuring cups—

1 notch to indicate 1 cup
2 notches to indicate 1/2 cup
3 notches to indicate 1/3 cup
and leave the 1/4 cup unmarked

For some people, only the 1/3 cup needs to be marked, since that is the most ambiguous size and the others are all identifiable because they are larger or smaller than the marked 1/3 cup. The same principles apply to measuring spoons.

Tactually marked jiggers are available through AFB. Inexpensive aluminum measuring cups sometimes have a raised line at each measurement allowing level of contents to be checked by touch.

In marking *appliances*, the goal is to make any *dials* legible to the homemaker with vision loss, and to make those markings secure and durable to withstand oil and moisture from hands and often from food and cooking residue. The overall task is to convert visual markings on the dials to lasting tactile markings.

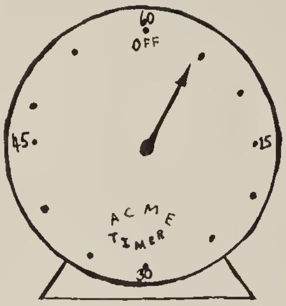
Visual dials may have many, and even very fine, markings. When switching to a tactile system, it is tempting to mark the existing visual system. However, the result is a jumble of unintelligible or indecipherable dots or lines, which the fingertip cannot discriminate. Therefore, the *first principle* is to put only essential markings in tactile form.

For instance, on an oven setting, mark only *low*, *medium*, and *high* . . . or, mark 200, 300 and 400. Since 350 is a common cooking temperature, the person using using the dial must make the accommodation of setting the dial halfway between 300 and 400. Some people need confirmation of three single dots to assure themselves that they have the 300° position. Other people with less precise tactual acuity prefer just one large and tangible dot at each position.

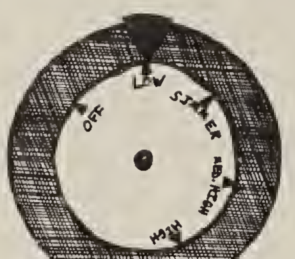
Some people study the dial with the aid of a sighted person and determine the "amount of turn" required for each setting. If the indicator, or center of the knob, is at the 12 o'clock position when indicating "off," then turning it to the 4 o'clock position may bring the dial to the low 250 (or whatever it is on that dial or appliance) setting. A half-turn, which is easily memorable may be noted for the number of degrees or the amount of time, if it is a timer, etc.

The second step in marking appliance dials is to decide whether the visual dial system should be made tactile, or whether a different approach may be more readable tactually.

Most dials fall into one of two categories. The first is an inner indicator which moves to stationary outer setting. The indicator moves to the desired fixed setting.



The second type of dial has an indictor outside of the dial which is fixed (usually either at the top or bottom of the dial). The individual setting are, in this type of dial, marked on the inner rotating dial and the individually chosen setting is moved to the indicator position. The dial is moving, and the indicator is fixed at the 12 o'clock position.



With this knowledge, any dial may be assessed to determine which system would be more suitable. (In some cases, space is so limited—on toasters, electric skillets, etc.—that only one of the two systems is possible, regardless of the visual system on the appliance.)

When a dial is symmetrical, with a center indicator going clear across the knob with a visually marked arrow, design, or color to show which end of the bar is the pointer or indicator, one may modify the pointer end by making a notch, placing a tiny round-headed brass screw or a drop of Hi Marks.

Note: Some materials are designed for marking, such as *embossing tape* and *magnetic tape*. In actual use, the adhesives on these ready prepared items is not strong enough to withstand handling involving heat and/or oil from hands, cooking or fuel. Glue must therefore be used to make a good bond. In most cases, a sighted person should be involved in the application of the glues and the markings. The new liquid "one drop" wonder glues are particularly tricky, as they will bond skin, and are very difficult to cotrol. They do provide a good bond, if there is no contour or air space between the label and the appliance, but should not be attempted by a visually impaired person.

Notches, made by a small three-cornered file, can mark the dial's surface. Take care to file the notch smooth, leaving no metal splinters that could injure the skin. And remember the physical limitations of the dial itself: four notches for 400 degrees may be not only confusing to the fingertip, but also destructive to the dial.

CONCLUSION

As we have seen, besides identifying food supplies, alternative labels in the kitchen can be used to mark measuring devices as well as dial settings on various appliances. In fact, alternative labels can help a person with vision loss to accomplish the same kinds of tasks—locating, distinguishing, identifying, or measuring—for items in nearly any household area.

For instance, in sewing, alternative labeling techniques and organizational skills can help distinguish spools of thread according to color. Braille clothing tags (available from the American Federation for the Blind) can easily attach to the spools if they are not to be used on a sewing machine. For use on a sewing machine, the central hole must remain open for the machine's spindle: to keep thread and bobbin of the same color together for use with a sewing machine, place both in a small jar, the lid of which has an alternative label to indicate color. To distinguish black and white threads, the most commonly used colors, one may purchase them in a size larger than the threads in lesser used colors; then they may be distinguished from one another by notches chipped into the spools: one notch to indicate, white, two for black.

Alternative lableing methods may also provide access to measuring equipment in sewing. On a cloth measuring tape, a staple at every inch marker and a set of crossed staples at each foot, will allow the tape to be used tactually. Just so, a wooden yard stick may be marked with staples or Hi Marks at each inch and foot.

Alternative labeling methods which apply to the kitchen and sewing areas can apply in principle to the shop as well. Organization, as always, is essential: to locate needed items, consider hanging each tool in a specific place on a peg board; affixing a magnetic strip to some portion of the work space to keep screws from rolling, and to gain instant access to them; setting out a tray with sides to contain all items needed for a project and thus to make them accessible; using plastic "organizer" boxes with many compartments, commonly available from hardware stores. The drawers or compartments may be labeled in braille or with an actual sample of the item glued to the outside. Also, consider using tactile measuring devices; tactile (braille or simply raised-line) rulers are commercially available. Notches, however, will not work on fine measurements, since the width of the notch itself would make for inaccuracy.

Finally, to identify keys, hardware stores sell caps which fit over the heads of keys. They are color-coded. If color cannot be perceived, then the caps can serve as a tactile identification among the uncapped keys. Nail polish on the head of a key makes a slippery-feeling surface which distinguishes that key from others. Likewise, a distinguishing notch can be filed into the head. Keys can be arranged in a particular order from a distinctive side of a key chain medallion (the key closest to the decorative side is to the front door, the second key is to the back door, and so on.) Adhesive tape can distinguish one key from another as well, or Hi Marks can be used either tactually or with low vision.

These final examples of alternative labels for use in daily tasks can serve to emphasize the principles to consider when designing such labels. To be useful, the labels must serve an individual's perceptual abilities, and they must be made of materials appropriate to the item, to its use, and to conditions of the area in which it will be used.

We began this issue with the premise that loss of vision brings a need for alternative labeling techniques and organizational

RESOURCES FOR ALTERNATIVE LABELS

The prices given are based on 1981 catalogues and lists. For up to date prices, write to distributors at addresses printed at the end of this resource guide.

READY-MADE LABELS

BRAILLE CLOTHING TAGS (ALUMINUM)

Approximately ½″ long in an oval shape, the tags come in sets of 2 each of 14 basic colors, indicated in braille: black, blue, brown, gray, green, pink, red, tan, white, yellow, gold, orange, purple, and silver. A hole at each end permits the tags to be sewn into clothing. Furnished through the generosity of the Telephone Pioneers of America.

American Foundation for the Blind
MS 244—Free with Regular Order

Independent Living Aids
058775—Free with Regular Order

BRAILLE PRESCRIPTION LABELS

Braille labels for prescriptions are available by mail or at walk-in locations. See the Washington D.C. address for this service at the end of the resource guide.

The American Association of Retired Persons

FOAM LETTERS

Designed for early learning activities, these large letters are made of non-toxic foam, flame resistant and washable. For labeling purposes, they can be attached to appropriate items with elastic strips or rubber bands.

American Foundation for the Blind
REC 4902—$5.50/set

FOAM NUMBERS

Same as Foam Letters. Size is 3″ x 3¼″, and the letters are approximately the same.

American Foundation for the Blind
REC 4909—$4.00/set

PLASTIC LETTERS

Plastic letters with an elastic attached for use in labeling household items are available. For prices write for catalogue.

Gladys Loeb Foundation

PLAYSKOOL MAGNETIC CAPITAL LETTERS

Use on canned goods or other steel surfaces as tactile symbols. Letters are 1½″ high, and the package contains 36 plastic letters. These letter sets are also available locally where toys are sold.

Independent Living Aids, Inc.
614677—$3.25

PLAYSKOOL MAGNETIC NUMBERS & ARITHMETIC SIGNS

Use on canned goods or other steel surfaces as tactile symbols, alone, or in combination with plastic letters to form codes. Numbers are 1½″ high, and the package contains 37 numbers and signs in all.

Independent Living Aids
614680—$3.25

Available locally where toys are sold.

LETTERS EMBOSSED ON PLASTIC SHEETS

Ready to be cut apart for labeling, sheets of plastic embossed letters are provided free of charge. Thermoformed, the letters are relatively clear tactually, and they are firm.

Telephone Pioneers
Kilgour Chapter

PLASTIC REPLICAS OF FOOD PRODUCTS

		With Elastics	Magnetic
Basic Kit	26 small fruits & vegetables	$2.75	$3.50
Master Kit	35 fruits & vegetables	5.00	6.50
Mini Kit	16 tiny markers	2.75	3.25
Maxi Kit	14 larger fruits & vegetables	3.75	4.25
Meat Kit	11 markers: meat cuts, poultry, sea food	2.75	3.00
Nut Kit	4 markers: walnut, pecan, peanut, almond	1.00	2.00
Mini Nut Kit	4 nuts on a ring	.75	.75
Dried Foods & Seeds (Misc.)	10 varieties	1.00	
	Individual fruits & vegetables	.25	.30
	Larger markers	.40	.45
	Double markers (peas & carrots; mixed fruits; mixed vegetables; vegetable soup)	.35	.35
	Individual meats		.45
	Individual nut markers	.25	.30

Gladys Loeb Foundation

BERNEICE JOHNSON BRAILLE LABELS FOR FOOD PRODUCTS

Mrs. Johnson's ready-made braille labels bear combinations of brailled initials and words such as "G Bean" for "green beans" and "Apple S" for "apple sauce." The labels are backed with magnets to attach readily to the top of canned goods. Elastic label holders are available for attaching labels to non-steel packaging. Labels may be ordered in any combination of up to seven characters. Allow approximately 30 days for manufacture and delivery.

Berneice Johnson
Braille labels—$ .25 each
Elastic label holder for non-steel packaging— .50 each
Metal piece to make elastic holder— .20 each
Metal display board for labels— 12.00 each

LOEB BRAILLE FOOD MARKERS

Mrs. Loeb's ready-made braille food markers consist of ½″ strips of magnetic tape brailled with names of individual meats, vegetables, fruits, spices. Sold in kits of 15, the labels may also be purchased individually.

Gladys Loeb Foundation

Meats	$1.50/kit
Vegetables	$1.50/kit
Fruits	$1.50/kit
Spices	$1.50/kit
Individual Labels	.15 ea.

BERNEICE JOHNSON LARGE PRINT LABELS FOR FOOD PRODUCTS

Mrs. Johnson's ready-made large print labels bear combinations of embossed initials and words such as "G BEAN" and "APPLE S." The labels are backed with magnets to attach readily to the tops of canned goods. Elastic label holders are available for attaching labels to non-steel packaging. Labels may be ordered in any combination of up to seven characters. Allow approximately 30 days for manufacture and delivery.

Berneice Johnson
Large Print labels .25 each

LOEB LARGE PRINT LABELS FOR FOOD PRODUCTS

Mrs. Loeb's ready-made large print labels are available in ¾″ and 1″ sizes. Embossed letters spell out abbreviations such as "CIN" for "cinnamon" and "PEA" for "peas." The ¾″ labels are magnetic and come in kits of 15.

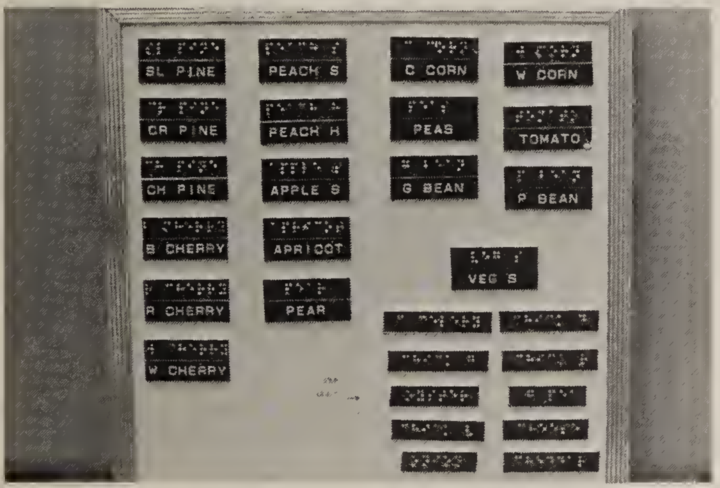
Gladys Loeb Foundation

Meats	$4.00/kit
Vegetables	$4.00/kit
Fruits	$4.00/kit
Spices	$4.00/kit
Labels on 1″ tape, no magnet	$5.00/kit

BERNEICE JOHNSON BRAILLE AND LARGE PRINT LABELS

Mrs. Johnson's ready-made food labels are available as combination braille and large-print labels. The line of braille is topped by the line of large print. Otherwise these labels are the same as Mrs. Johnson's single-line braille and large print labels.

Berneice Johnson
Braille & Large Print, 2 lines—$.50 each

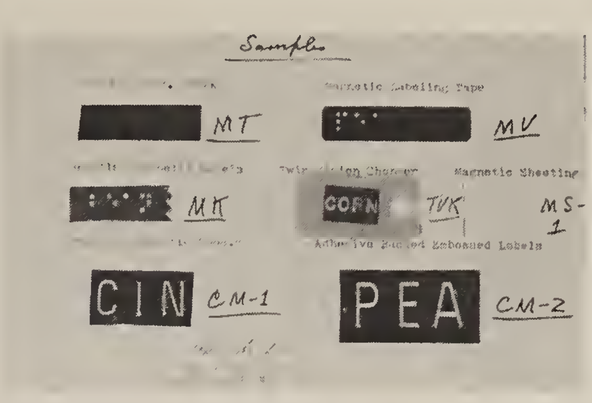


LOEB TWIN-VISION SHOPPERS

Mrs. Loeb's manufactures labels called Twin-Vision Shoppers which are flat plastic clips (commonly used as closures on bread packaging) bearing a brailled label on one side and embossed print on the other.

Gladys Loeb Foundation

Meats	$1.50/kit
Vegetables	$1.50/kit
Fruits	$1.50/kit
Spices	$1.50/kit



The Loeb Twin-Vision Shopper is pictured here (center label, center row) among other labels available from the Gladys Loeb foundation.

EMBOSSED FOOD LABELS

Thermoformed sheets of plastic labels embossed with names of common food products: corn, beans, peas, etc. The embossing is somewhat soft so that the letters can collapse with frequent or heavy use. Free.

Telephone Pioneers
Kilgour Chapter

LABELING TAPE

"LABELON" BRAND "WRITE-ON-IT" TAPE

This pressure-sensitive tape can be brailled in a standard braille slate, or it can receive large print produced by ballpoint pen, pencil, or braille stylus. It is backed with adhesive. The AFB recommends the following procedure for brailling Labelon on a regular braille slate: simply use the adhesive backing to stick it lightly to the top flap of the slate since it is too large for the tape slots; release by pushing up a corner with the stylus and remove. It comes in ¾″ widths and 1″ widths; the wider tape can receive two lines of braille. The tape is white with narrow borders in blue, or with a variety of border colors if purchased locally. Rolls of tape come in plastic dispensers.

American Foundation for the Blind
¾″ x 80″, MC 150—$1.60/roll
1″ x 400″, MC 151—$4.50/roll

Independent Living Aids
¾″ x 80″, 427777—$1.50/roll
1″ x 400″, 427780—$4.35/roll

Available locally where stationery or office supplies are sold.

"SCOTCH" BRAND "WRITE-ON" LABEL TAPE

This pressure-sensitive tape can receive pencil or ink to produce large-print labels, or braille in a standard braille slate. (Try suggestions for Labelon.)

¾″ x 60 yds., $2.40/roll
1″ x 60 yds., $3.00/roll

Available locally where stationery or office supplies are sold.

"SCOTCH" BRAND "WRITE-ON-LABEL TAPE" DISPENSER

The tape dispenser has a writing platform which holds 4¼″ of tape for comfortable writing in front of the cutting edge for the tape. It is designed to hold "Scotch" Brand Label Tape above.

$12.50

Available locally where stationery or office supplies are sold

VINYL LABELING TAPE (½″)

Vinyl labeling tape comes with an adhesive backing. The ½″ wide size can be brailled in a single-line slate or in slates with tape slots; or it can be brailled in the 3M Braille Labeler or Dymo Braille Labeler (hand-held tape embossing "guns"). In the Dymo Heavy Duty Labeler it produces labels with ¼″ high print in all-capital letters. There are different brands of vinyl labeling tape available in a variety of colors (or clear): "Scotch," "Dymo," and "Rotex" tapes may be purchased locally where stationery and office supplies are sold; ½″ vinyl labeling tape may also be ordered from the following distributors.

American Foundation for the Blind
3 rolls of tape, ½″ x 144″, BC 1—$4.00

Howe Press
Dymo Brand, Clear, ½″ x 144″, $1.50/roll

Independent Living Aids
3 rolls of tape, ½″ x 144″, 830055—$3.95

Science for the Blind Products
Rotex Brand, Clear, ½″ x 144″, $4.95/3 rolls
$15.00/10 rolls

Available locally where stationery and office supplies are sold.

VINYL LABELING TAPE (¾″)

The ¾″ wide size of vinyl labeling tape is designed to fit tapewriters or labelers (hand-held tape embossing "guns") which make letters ½″ high. The tape comes in a variety of colors, and the letters come out white, sharp, and non-collapsing, for low vision use. This size is available locally in the "Rotex" or "Scotch" brands of vinyl labeling tapes. It may also be ordered from ILA.

Independent Living Aids
¾″ x 288″, 830060—$4.95/roll

Available locally where stationery and office supplies are sold.

ALUMINUM LABELING TAPE (½″)

Aluminum labeling tape is for use outdoors or near high temperatures. Its ½″ width permits it to be brailled in standard slates. It is adhesive-backed.

Howe Press
Dymo Brand Aluminum Tape, ½″ x 144″, $2.50

Available locally where stationery and office supplies are sold.

MAGNETIC LABELING TAPE (½″)

Magnetic labeling tape comes with a magnetic backing. It can be directly brailled in a slate or in a 3M Braille Labeler or Dymo Braille Labeler (hand-held tape embossing "guns"). In the Dymo Heavy Duty Labeler it produces *light-weight* magnetic labels with ¼″ high print in all-capital letters. Magnetic backing permits label to hold lightly to steel-content surfaces (such as cans) and to be re-used.

American Foundation for the Blind
½″ x 96″, BC 324—$4.00/roll

Independent Living Aids
½″ x 96″, 454344—$3.85/roll

MAGNETIC LABELING TAPE (¾″)

This size is designed for use in tapewriters that take ¾″ tape to produce letters ½″ high. Magnetic backing permits label to hold *lightly* to steel-content surfaces (such as cans) and to be re-used. It is sold locally as a "Scotch" Brand tape; it may also be ordered from ILA.

Independent Living Aids
¾″ x 197″, 454358—$9.95/roll

Available locally where stationery and office supplies are sold.

HEAVY MAGNETIC SHEETING STRIPS

Magnetic sheeting anchors to steel-content surfaces much more *firmly* than magnetic labeling tape. Strips of this flexible, magnetic material are 1″ wide and approximately 1/32″ thick. To use it in making permanent, re-usable labels, use it as a backing for any other kind of labeling tape which has first been brailled, embossed with letters, or printed with letters. Manufactured by Identification Systems, Inc., it is available locally in packages of 6 strips (½″ x 4″) or 3 strips (1″ x 4″) at under $2.00 per package. Strips may also be ordered from the following distributors.

Gladys Loeb Foundation
Magnetic Sheeting, 1″ x 8″, $.50/inch

Howe Press
Mag-Strips, 1″ x 12″, $.66/inch

CANNED GOODS MARKER KIT

The kit has 25 strips of ¾″ wide sturdy, clear plastic ready for brailling. Each strip can make four standard sized labels for canned goods. Included are 25 elastic fasteners with patented clips and a heavy-duty punch for making fastener holes on each end of the label. Extra plastic strips, elastic fasteners, and punches may be purchased separately.

Labels are to be brailled with a slate, but slate and stylus are not included in the kit. The plastic strips are too wide for the tape slots in a standard slate; however, a single-line slate, whose top and bottom plates are hinged together like a book, can hold the strip firmly for brailling.

American Foundation for the Blind
KS 129—$3.95

LOEB LABEL MAKING SUPPLIES

Elastic band fasteners, 12″	$ .10 each
Magnetic materials	
½″ wide magnetic tape (blank)	1.10/yard
magnetic sheeting, 1″ x 8″	.50/inch
Magnetic tape for direct brailling	
½″ wide, 8′ long	3.00
½″ wide, 4′ long	1.75
¾″ wide, 197″ long	8.25
¾″ wide, 49″ long	2.25

Embossing tape with adhesive backing (blank)

½″ wide, 188″ long (red, blue, yellow, green, clear)	1.00
¾″ wide, 288″ long (no color choice)	3.75
¾″ wide, 96″ long (no color choice)	1.50
1″ wide, 36″ long (no color choice)	8.00
1″ wide, 12″ long (no color choice)	3.25

Gladys Loeb Foundation
Write for catalogue of labeling material.

PLASTIC FOR BRAILLE LABELS

BRAILON

Sheets of moisture and oil proof plastic come in a package of 500. They may be brailled in a standard brailler or with slate and stylus. (Approximately 9″ x 12″.)

American Thermoform Corporation
$18.30/package of 500 sheets

HEAVY BRAILON

Heavier than regular Brailon, Heavy Brailon may be described the same in other respects. The price below is per package when 6 packages are ordered.

American Thermoform Corporation
$17.50/package of 500 sheets

BRAILLABLE

Sheets of plastic which make durable braille and have an adhesive backing for ready labeling. Each package contains 12 sheets (approximately 9″ x 12″). Braillable is transparent to allow original print of conventional labels to show through.

American Thermoform Corporation
$11.40/package ordered singly
$10.80/package order in quantity of 12

PLASTIC-STICK LABELS

Clear vinylite sheets, laminated with a pressure-sensitive adhesive, which in turn has a fine plastic protective coating, are to be brailled, cut to size, and applied to a cleaned surface. The translucent material permits print to be read through it. It comes in a single 9″ x 12″ sheet.

American Foundation for the Blind
MC 145—$2.00/sheet

Independent Living Aids
612533—$1.90/sheet

PLASTIC FILE CARDS

Made of vinylite, these file cards take ink, pencil, or typing as well as braille and so could make combination large print and braille labels, as well as twin-vision labels. They make sturdy braille. They may be brailled with either slate or machine and used either as labels or file cards (as intended). They are white and opaque.

American Foundation for the Blind
3″ x 5″, MC 146—$3.40/package of 25
4″ x 6″, MC 147—$3.50/package of 25

SLATES FOR MAKING BRAILLE LABELS

SINGLE LINE SLATE

The Single Line Slate, with stylus, has 25 cells. It is for use with labeling tape. The two plates are hinged at the long edges so that the slate opens and closes like a long, narrow book. This permits the tape to be laid between the two plates and held firmly when they are closed. It is made of aluminum.

Howe Press
$5.00

POSTCARD SIZE SLATE

Designed to braille material the size of a postcard, this slate also has slots through which to thread ½″ labeling tape to be held for brailling a label. Unless otherwise specified, the slates are made of aluminum.

American Foundation for the Blind
19 cell/6 line WS 313—$8.50

American Printing House
19 cell/4 line $7.95
(comes with stylus)

Howe Press
19 cell/6 line $9.00

Independent Living Aids
19 cell/6 line 126709—$8.50

"JIFFY" POSTCARD SIZE SLATE

Designed to braille 3″ x 5″ cards *only*, the slate has no pins or hinge. The two plates are welded together permanently with space enough between to admit the 3″ x 5″ card and hold it steady for brailling. Made of aluminum, the slate comes with a stylus.

Howe Press
19 cell/6 line $10.00

POCKET SLATE

This model can braille labels on paper, plastic, or labeling tape since it has the slots necessary for holding the tape. It has 27 cells and 4 lines and is made of aluminum unless otherwise specified.

American Foundation for the Blind
27 cell/4 line, WS 311—$8.50

American Printing House
28 cell/4 line
Aluminum $8.45
Plastic 1.25

Howe Press
27 cell/4 line
Aluminum $8.00
Brass 10.50

Independent Living Aids
27 cell/4 line
Aluminum 126711—$8.50
Plastic 126707— 1.95

BRAILLE SLATE KITS

POCKET BRAILLE SLATE KIT

A 19-cell by 6-line slate and pencil stylus which is held in one pocket of a 3⅝″ x 6½″ vinyl cover. There are two other pockets for braille paper in the appropriate size, a supply of which is included.

American Foundation for the Blind
Kit, WS 315—$16.00
Extra paper, WS 320—$1.00/100 sheets

SMALL LOOSE LEAF POCKET NOTEBOOK

Extra braille paper for this notebook, 3½″ x 6⅛″, comes with the notebook and its 20-cell, 8-line slate. The paper is punched with holes to fit the rings of the notebook.

Howe Press
$16.50

DESK/WALL BRAILLE SLATE MEMO KIT

A roll of memo paper fits at one end of this braille slate while the magnetic stylus attaches to the metal plate at the other end when not in use. The memo paper is fed through a plastic 20-cell, 5-line braille slate. Replaceable paper roll is estimated to produce 168 memos which could be used as well for 168 labels, especially if the paper is reinforced with transparent tape to make sturdier braille.

Independent Living Aids
Kit, 230600—$17.95
Refill paper, 656950— 1.95
Replacement magnetic stylus, 658233— 1.95

SPECIAL BRAILLER

BANKS POCKET BRAILLE WRITER

A miniature version of the standard brailling machine, the Banks Pocket Brailler has six keys to emboss a single line of braille characters on *paper* tape. Much like ticker tape, this paper tape designed for use in the Pocket Brailler will make labels of a suitable size, but the relatively flimsy paper will render the label only temporary.

Lions Club
Available locally only through Lions Clubs.

LABELMAKER FOR BRAILLE

3M BRAILLE LABELER

This hand-held labeling "gun" embosses *braille* on ½″ vinyl and magnetic tape. Simply dial the desired character and squeeze the handle; the "gun" clicks out the tape embossed with the braille. The "gun" can emboss the complete alphabet, number sign, commonly used contractions and word contractions plus many punctuation marks. The upper rim of the dial is brailled; lower rim has standard alphabet to indicate braille character embossed.

American Foundation for the Blind
BTW 400—$40.00
Replacement Dial, BTD 416—$13.00

LABELMAKERS FOR LARGE PRINT

STANDARD ALPHABET DIAL FOR 3M BRAILLE LABELER

This dial may be placed in the 3M Braille Labeler to produce *large black capital letters* on vinyl or magnetic tape purchased from AFB. Capital letters in white result from using some other brands of vinyl labeling tape, such as "Scotch" Brand.

American Foundation for the Blind
STD 417—$7.25

3M LARGE PRINT LABELER

This portable labeling "gun" embosses *large sharp letters* and numerals (½″ high) on a ¾″ wide tape. Dial is not brailled. One roll of black (¾″) tape is included with labeler. The letters print out white.

Independent Living Aids
430700—$89.95
Available locally where stationery and office supplies are sold.
Approximate cost, $110.00.

DYMO HEAVY DUTY TAPEWRITERS

The *letters* produced on labeling tape (½″) are ¼″ high. There are two models of heavy duty tapewriters under the Dymo brand which produce this size letter.

Both Upper and Lower Case, $89.95
Only Capital Letters, $69.69
Available locally where stationery and office supplies are sold.

DYMO HEAVY DUTY PORTABLE SIGNMAKER

The Dymo Heavy Duty Portable Signmaker (2300 MK II) is portable, about the size of a cassette tape recorder, and rests on a table top when in use. It prints ½″ high letters on ¾″ labeling tape, in both upper and lower case.

Available locally where stationery and office supplies are sold.
Approximate cost: $150.00.

EQUIPMENT FOR MAKING TACTILE LABELS

HI MARKS

Hi Marks can produce both tactile labels and low vision labels. It is a fluourescent orange, paste-like substance that is squeezed from a tube to make any raised three-dimensional shape—large print letters, braille dots, or raised lines and geometrical shapes for use as symbols, codes, dots, or raised lines and geometrical shapes for use as symbols, codes, etc. Applied directly from its tube applicator, the Hi Marks can be used on paper, cloth, wood, and metal. Because it withstands washing it can be used on clothing; it can mark canned goods, kitchen and book shelves, etc.

American Foundation for the Blind
WS 462—$3.00/tube

Independent Living Aids, Inc.
785311—$2.95/tube

FELT DRAWING BOARD

The Felt Drawing Board is a gadget for drawing pictures that can be perceived by touch. It is an 8″ x 10″ board wrapped by a piece of heavy felt. By using a ball-point pen or other blunt writing implement, raised line drawings, letters, or braille may be made freestyle on braille paper or heavy aluminum foil placed on top of the felt. Because a *mirror image* of all letters and words emerges in raised form on the "good" side of the material for the label, the user must take care to *form letters in reverse* and to *write from right to left.*

Science for the Blind Products
T-29—$8.50

RAISED LINE DRAWING KIT

The kit contains a rubber covered drawing board with hold-down clips for 8½″ x 11″ material, a ball-point pen filled with a colorless lubricant, and a package of Mylar polyester film sheets for use as "paper." A polyester film sheet (the "paper") fits under the clips and over the rubber covered drawing board; drawing with the ball-point pen makes a ridged line. The "good" side of the label faces up so that the user may write and draw in normal fashion. Any line, shape, or letter can be felt and tactually, as well as visually, traced.

American Foundation for the Blind
Kit, WS 293—$22.00
Extra Mylar, WC 285—$4.00/70 sheets

SENSORY QUILL

The Sensory Quill is a machine which makes raised lines when the user moves its stylus over Brailon paper or 3-4 mm aluminum foil. Originally designed for employment application, it is used by mathematicians, engineers, computer programmers, architects for such projects as plotting data on graphs, making flow diagrams, preparing drawings. With access to this device, tactile lines, geometric shapes, letters or symbols for tactile labels may be made.

Mechstat, Inc.
Individual model—$295.00
Institutional model—$745.00

FISHBURNE ALPHABET EQUIPMENT

The Fishburne Alphabet, composed of lines and dots larger than standard braille, can serve as a medium for tactile labels as well as a variety of communication purposes. The system may be self-taught through a course on cassette tapes.

Telephone Pioneers
John I. Sabin Chapter
Sample Sheet—Free

Fishburn Engineering

Sample Sheet	Free
Training Alphabet	$4.60
Teaching Cassettes	.75
Embosser	21.00
Extra Metal Slate	.75
Tape Cutter	10.50
Vinyl Tape, ½″ x 12′	1.25
Magnetic Tape, ½″ x 1′	.60
Magnetic Tape Scored in 1″ lengths, ½″ x 1′	.75
Tape cut in 1″ strips	2.20

GILLIGAN TACTILE LABEL-MAKER

The kit includes the template for embossing letters, a standard braille stylus, and 10 sheets of label-maker plastic which can be embossed with letters and cut to the size desired for a label. See text of Embossed Letters section of this Review for complete description.

Gilligan Tactiles
Kit—$14.00
Kit with Perkins Small Wheel Stylus—$21.90

EQUIPMENT FOR AUDIBLE LABELS

VOXCOM MARK II SPEED CARD READER ADAPTER

Pictured in the Audible Labels section of this Review, the Mark II Speed Card Reader Adapter is a device which records and plays back sound on materials striped with Talk/Tape. To record, the Card Reader Adapter must first be placed in the cassette well of a modified host cassette recorder. The modified host cassette recorder is manufactured only by Voxcom.

Voxcom
Mark II Speed Card Reader Adapter, CRA-20—$89.00
Modified Host Cassette Recorder, 61H—$89.95
(The host unit has the appearance and performance features of a regular cassette tape recorder.)

VOXCOM PHOTO RECORDER

This device is a single unit which records and plays back messages on cards the size of snap shots or note cards which have received a strip of Talk/Tape, adhesive-backed magnetic recording tape. It operates with only one button. Its compact size, 5½″ x 5″ x 2″, allows the Voxcom Photo Recorder to fit easily in a brief case.

Voxcom
Photo Recorder—$69.95

TALK/TAPE

Talk/Tape is adhesive-backed magnetic recording tape that can be attached to paper materials (note cards, postcards, etc.) so sound can be added by a card reader adapter or the Voxcom Photo Recorder. It comes rolled in a dispenser box to be cut to length and applied to paper material.

Voxcom

Talk/Tape, 500″	TR-500	$8.50
1000″	TR-1000	14.50
2500″	TR-2500	25.00

VOXCOM TALK/CARD

A Talk/Card is a pre-striped, blank card, designed to make short recordings when placed in a Voxcom Card Reader Adapter or in the Voxcom Photo Recorder. See Audible Labels section of this Review for suggestions on use as labels.

Voxcom

Talk/Cards, 3½″ x 7″	TC71-50	$5.95
3½″ x 10″	TC101-50	$6.75

50 cards per package.

A complete Voxcom catalogue is available from the company

RESOURCE ADDRESSES

American Association of Retired Persons
"Braille Labeling"
c/o NRTA/AARP Pharmacy Service
Suite 1190
1750 K Street
N.W. Washington, D.C. 20006

American Foundation for the Blind
15 West 16th Street
New York, NY 10011

American Printing House for the Blind
1839 Frankfort Avenue
Louisville, Kentucky 40206

American Thermoform Corporation
8640 East Slauson Avenue
Pico Rivera, California 90660

Berneice Johnson
717 4th Street, No. 114
Des Moines, Iowa 50309

Fishburne Engineering
221 N. Gordon Drive
Winston-Salem, North Carolina 27104

Gilligan Tactiles
34 Kilburn Road
West Newton, Massachusetts 02165

Gladys Loeb Foundation
2002 Forest Hill Drive
Silver Spring, Maryland 20903

Howe Press
Perkins School for the Blind
175 North Beacon Street
Watertown, Massachusetts 02172

Independent Living Aids, Inc.
11 Commercial Court
Plainview, New York 11803

Mechstat, Inc.
North East Loop 410
Suite 210
San Antonio, Texas 78209

Science for the Blind Products
Box 385
Wayne, Pennsylvania 19087

Telephone Pioneers
John I. Sabin Chapter
2700 Watt Avenue
Sacramento, California 95821

Telephone Pioneers
Kilgour Chapter
209 West 7th Street, Room 107
Cincinnati, Ohio 45202

Voxcom
Division of Tapecon
100 Clover Green
Peachtree City, Georgia 30269

methods. Loss of vision can diminish one's ability to locate, to distinguish, to identify, and to measure, and can thus markedly limit access to items normally a part of daily life. This issue presented a variety of alternative labeling techniques and organizational methods to help restore that access and the personal independence that comes with it. This issue concentrated on methods for devising alternative labels for access to household items ranging from kitchen equipment and cooking supplies to household financial documents. Yet, clearly, the principles of label design here could apply as well to developing alternative labels for storage and retrieval of items, equipment, and information needed in the work or professional setting.

Finally, we know we have neither exhausted the possibilities for labeling techniques nor have we examined all the areas of living where alternative labels might be needed. Thus, we invite our readers to tell us about their unique labeling techniques or unexpected uses for alternative labels and organizational methods. As we said in the introduction to this issue, we look forward to sharing this information.

BIBLIOGRAPHY ON LABELING

"Braille/Large Print Medicine Labels." *Inter-Regional Review*, 69, Summer 1981, p. 57.

An announcement from *In Touch* bulletin, April 1981, is reprinted: available in England at registered pharmacies are ready-prepared braille/large print plastic tie-on labels providing dosage instructions for prescription medicines. Labels are free of charge to customers.

Cumberland, Charlene Harding. "Foods in Classes for the Blind: A Paper to be Presented at the Home Economics Section Meeting, American Association of Instructors of the Blind, Fortieth Biennial Convention." Typed, unpublished manuscript in the collection of the Samuel P. Hayes Research Library, The Perkins School for the Blind, Watertown, Massachusetts.

On page 5 the author mentions the uses of braille labeling for food items, gives some examples of the effectiveness of tactual recognition of many food items and packages; and she notes the need for storage techniques to promote location and recognition of needed items.

Finch, Jessica. "Labelling Methods for the Visually Handicapped." Typed manuscript prepared as text for illustrated catalogue compiled to accompany exhibition on labeling sent to various parts of England.

Straightforward and comprehensive description of labeling materials, equipment and unique labeling uses. For a taped version of the text, send one C.60 cassette to A.D.A. Reading Services for the Blind, 12 Renhold Road, Wilden, Bedford, England.

——— **"The Naming of Things."** *The New Beacon*, LXIV: 758, June 1980, pp. 148-149.

A lively presentation of imaginative suggestions for devising a personal household labeling system, using materials and equipment available from the Royal National Institute for the Blind, London, England. Tips for containers, labeling materials, equipment, placement of labels, space-saving codes for identification, and unique uses for labels.

Jones, Sally. *Preprimer Cooking or Cooking Techniques for the Blind.* Louiseville, Kentucky: American Printing House for the Blind, 1973.

The author gives tips for the use of organization for identification of items stored (pages 11-14, 17-18, 21-22). On pages 44-47 she gives instructions for making braille labels and for recognizing many food items tactually.

Klinger, Judith Lannefeld. *Mealtime Manual for the Aged and Handicapped.* New York: Essandes Spiral Editions, Simon & Schuster, 1970.

——— *Mealtime Manual for People with Disabilities and the Aging.* Camden, New Jersey: Campbell Soup Company, 1978.

Provides a few suggestions for organizing kitchen storage and for marking appliance dials and timing devices.

"Labels, Tags," in *International Guide to Aids and Appliances for Blind and Visually Impaired Persons*, Second Edition. New York: American Foundation for the Blind, 1977, p. 206.

Provides resources for labels and labeling equipment in England, West Germany, Japan, Norway and Sweden.

Loeb, Gladys E. "Braille Labeling and Managing Food and Supplies for the Blind Homemaker."

This pamphlet may be ordered in its entirety from the Gladys Loeb Foundation, 2002 Forest Hill Drive, Silver Spring, Maryland 20903. Approximate cost: $1.00. Excerpts are printed in the text of this issue of AAR.

Wagner, Jane Tiffany. "Training the Blind to Cook," *Forecast for Home Economists*, June, 1953, p. 46.

There is mention of the necessity of systematic organization and alternative labels for use by the homemaker with vision loss.

Wehrum, Mary E. *Techniques of Daily Living: A Curriculum Guide.* Pittsburgh: Greater Pittsburgh Guild for the Blind, 1977.

The Guide addresses the various daily living skills needed by people with vision loss and gives step-by-step instructions for teaching those skills. Pages 61-62 give labeling and organizing techniques for storing and selecting clothing; pages 78-79 describes uses of categorical arrangement in identifying food products and canned goods in a supermarket—some techniques could be applied to home storage. Describes use of tactual cues in selecting desired items.

Yeadon, Anne, et alia. *Self-Study Course 1: Housekeeping Skills—A Cassette Course for Newly Visually Impaired Individuals.* New York: New York Infirmary/Center for Independent Living, 1975.

Lists of suggestions for using braille and other systems of marking items in the kitchen may be found on pages 107-109. Instructions for using the AFB's Canned Goods Marker Kit are given on pages 170-172 along with uses of alternative labeling in storing canned goods and in marketing. Pages 172-174 give instructions in the use of tactile labels devised by Mrs. Gladys E. Loeb.

——— *Toward Independence: The Use of Instructional Objectives in Teaching Daily Living Skills to the Blind.* New York: American Foundation for the Blind, 1974.

Page 53 outlines the uses of alternative labels for recognizing specific cooking utensils; pages 74-77 describe braille and color for low vision as methods of marking appliance dials.

PROBLEM CORNER

Recently, NBC's *Today Show* aired a series of short features on computers—entitled "The Wired Society." It is no exaggeration to say that computers have become a part of our day-to-day lives. They have, in fact, become indispensable to business in this country, and many of us can expect them to become a part of our vocations. With expanding computer technology, computers are ever more versatile—they do everything now from sending out electric bills and phone bills to totaling your grocery bill as you check-out at the supermarket. Computers provide quick access to all kinds of stored data, making them useful to even small, non-profit organizations—like The Carroll Center. (Our terminal ties in with the computer of a local university to retrieve the names on AAR's mailing list and print out the address labels needed to distribute each issue.) Expanding computer technology also means that computers can be built ever more cheaply so that even smaller businesses and some households can afford to own a terminal and use the services of a computer.

Computer programming is no longer the only occupation in which a person can expect to be concerned with computers; today many different kinds of job descriptions require some interaction with computers, at least the ability to enter and retrieve data. For the population with vision loss, the vocational problem becomes one of how to gain access to computers. How do members of this population become part of "The Wired Society." To help solve this problem, we feel there is an immediate need for knowledge about sensory aids that permit people with vision loss access to computers. For a future issue we are thus researching and compiling information about sensory aids for access to computers and computer-related systems. We are seeking information about specific, existing sensory aids; about any such sensory aids that might be in research; and about personal, vocational experience of such aids. Can you provide any information? Can you share your experience of any sensory aids for access to computers? Or can you pass our request on to a knowledgeable colleague? Or provide us with that colleague's name so that we might make contact with him or her? Can you help us with our search?

NEWS FROM THE FIELD

Innovative Rehabilitation Technology, Inc. has announced the publication to *Technical Innovations Bulletin.* A distributor of technical innovations to aid the handicapped in day-to-day life, IRTI makes available cassette recordings of the products which can be ordered. Now an annual subscription to IRTI (predicted to cost from $12.00 to $15.00) includes not only the cassette-recorded catalogues of products, but also quarterly issues of *Technical Innovations Bulletin*, also recorded on cassette. IRTI gives this description of the Bulletin:

> *Technical Innovations Bulletin* is a service to increase awareness with respect to new products, how these products are being used by consumers, to discuss the impact of technology on disabled persons, to talk about research, employment issues, and some fun or entertainment products. Your suggestions will be seriously considered.

The address for IRTI is 375 Distel Circle, Suite-A-11, Los Altos, California 94022.

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AIDS AND APPLIANCES REVIEW

THE CARROLL CENTER FOR THE BLIND
770 Centre Street, Newton, MA 02158
(617) 969-6200

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DIABETIC CONTROL: EQUIPMENT FOR USE WITH VISION LOSS

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Introduction

by

Donna L. Johnson

The person experiencing the condition known as diabetes mellitus soon learns that living and growing in harmony with it requires adaptation of lifestyle to meet the body's needs. It is important for the diabetic to learn to live, and grow, and enjoy life as naturally and independently as possible, yet as a conscientious diabetic. It is only by working with the body and not against it that the person can hope to achieve maximum health. To be successful, he or she must be educated about and willing to adjust to the necessary modifications now required to keep the body functioning as stably as possible. He or she needs to know about the causes, symptoms, and treatment of a very high or very low blood sugar; he or she needs to know how injected insulin, food intake, exercise, and stress affect the level of sugar in the blood in order to plan and carry out the tasks of diabetic control: monitoring glucose levels, proper food management, and corresponding insulin adjustments.

Even with conscientious attention to adapting lifestyle to the body's needs, the diabetic can experience serious long-term medical complications. Among them are cataracts, glaucoma, and diabetic retinopathy—a disease which affects the small blood vessels on the retina. For those persons experiencing legal blindness because of these eye complications, learning to continue living in harmony with their diabetes is still important. This harmony can be attained by gaining a better understaning of the condition itself and by learning to use special aids and appliances in place of eyesight: various special syringes and gauges for measuring the insulin; enlarged test tapes, charts, or audible analyzers for urine-glucose monitoring; brailled or taped diabetic diets, meal plans and cookbooks.

To assist the visually impaired diabetic in gaining this education, it is essential for the person working with him or her in rehabilitation to gain a basic knowledge of the diabetic's individual physical and psychological needs. Although diabetics share common traits, each person remains unique, with special, individual rehabilitative needs. It is imperative for the rehabilitation community to respond appropriately to these needs to make a positive difference in lives of persons with diabetes and vision loss.

Editor's Note

Diabetic control, with sight or with vision loss, is a complex procedure. Maintaining control of blood glucose levels—the central task—requires careful dedication to a routine which, to say the least, can impinge on very human desires to live spontaneously and to follow impulses—impulses to do what everyone else is doing, maybe just filling up on McDonald's french fries when the rest of the gang does it so harmlessly. But with diabetes such impulses can lead to the high levels of blood glucose characteristic of the condition—with damaging results.

Besides corralling such impulses, good diabetic control requires harnessing energy into a network of daily routines. Daily life must fit the routines of testing urine or blood for glucose as often as four times per day; measuring and injecting insulin at least once, and for some people, four times per day; and eating in accordance with an unvarying schedule of meal times and precisely planned menus. The regimen is intricate. Even with sight, handling it successfully demands a high degree of motivation, commitment, knowledge, and skill.

Ordinarily, in fact, sight is critical to the tasks of diabetic control: to test for glucose in urine or blood, a color change on a narrow reagent strip must be matched to the colors of a glucose percentage chart; the fine-line unit scale on the syringe must be read accurately to draw up the insulin dose for injection; to maintain the prescribed diet, ingredients and food portions must be measured in calibrated cups or spoons or weighed on a scale meant to be read with sight. The necessity for special, nonvisual devices and adapted techniques can become urgent with vision loss, a potential complication of diabetes. This issue of AAR aims to provide up-to-date product information about much of the available equipment designed for management of these tasks with vision loss; in addition, it includes blood glucose testing equipment, not yet adapted for use without sight. Of course, these devices must be used with knowledge of diabetes itself.

However, AAR does not pretend to make any steadfast pronouncements about diabetes or diabetic care. Within the field of diabetic care, controversy continues over such crucial topics as the best methods of insulin delivery and the role of high blood glucose levels in causing diabetic retinopathy. Few issues are settled. Given this present lack of orthodoxy, even approaching an understanding of diabetes can be a complicated undertaking with an uncertain outcome.

We would stress that no part of this issue should be taken as medical advice; we present all material about diabetic care in hope that it will provide points of departure for a continuing search for better understanding of diabetes and its control. Some, or much, of this material may differ from the clinical practices of some established medical centers—since variance in approach is a fact of diabetic care. And approaches and techniques described in this issue may well differ from the prevailing habits of blind diabetics embarking on a course of learning therapeutic techniques anew with vision loss. Recognizing such conflicts, we present all material on diabetic care per se advisedly. We offer it to those in the field of blindness rehabilitation who would begin to learn about diabetes and diabetes care as a necessary context for evaluating the devices and techniques which may be useful to the blind diabetic in the rehabilitation setting: aids for insulin administration, for blood and urine monitoring, for diet and exercise management.

To provide the background for the articles on aids, Issue No. 6 of AAR begins with an explanation of the condition and a brief history of insulin therapy.

Robert McGillivray
Marlene Gast

INSULIN THERAPY

Diabetes: Some Physiological Considerations for the Blind Person

by
Richard M. Connors, M.Ed.

The existence of numerous "Fifty Year" diabetics testifies to the fact that diabetes can be controlled; essentially normal lives can be lived with it.[1] For this to be so, however, the condition must be understood, faced for what it is, and dealt with. It is the goal, hopefully, of those of us involved in the rehabilitation of the blind diabetic to help him develop a state of health and continued expectation of health in which he himself will be the prime participant.

Advances in our understanding of the disease and important technological advances like home blood glucose monitoring have at last made this ideal possible.

Diabetes is not an easy disease to understand. The variety and complexity of books currently available on the subject amply demonstrate that. Many of these books are very good and treat the mechanics of control in great depth. This brief article does not seek to take their place. Rather we will try here to draw the reader's attention to some simple facts and illustrations which may contribute something to an overall understanding of the disease and give a framework for the material to follow.

Diabetes is defined as the state caused by insufficient available insulin.[2] Long ago it was noticed that there are two major forms of the disease. Various terms have been applied to these forms over the years: juvenile-onset and adult-onset; Type I and Type II; insulin dependent and non-insulin dependent. The latter terms are the ones in current use and reflect the present understanding of the condition. Insulin-dependent diabetes *tends* to have its onset among juveniles (hence the original term for it), but is now being called insulin dependent because that appears to be the salient characteristic: control cannot be achieved without daily injections of insulin. Non-insulin dependent diabetes, on the other hand, responds well to weight loss, diet, exercise, and oral medications. Since insulin-dependent diabetes is overwhelmingly the form we deal with among the blind, this article will confine itself to the insulin dependent form.

Insulin is a hormone produced in the pancreas. It must be present in order for sugar circulating in the blood to pass through the walls of the blood vessels and reach the body tissues. Since sugar is the body's fuel or energy supply, the breakdown in sugar metabolism which occurs in diabetes is life-threatening unless corrected.

The body is a self-regulating system, with constant back-and-forth communication going on among the various parts of the system. Normally, sugar and insulin exist in harmonious balance. When a low level of sugar exists in the body's tissues, the perception of a need for food arises. Appetite is stimulated; we feel hungry; we eat. As we do, the resulting rise in blood sugar stimulates the release of insulin. Interaction of insulin and blood sugar allows the sugar's passage into the tissues. Hunger is slaked; eating stops; excess sugar is transformed into fatty substances for storage. Insulin release gradually shuts down; the system returns to static equilibrium. This interaction between sugar and insulin can be roughly diagrammed as follows:

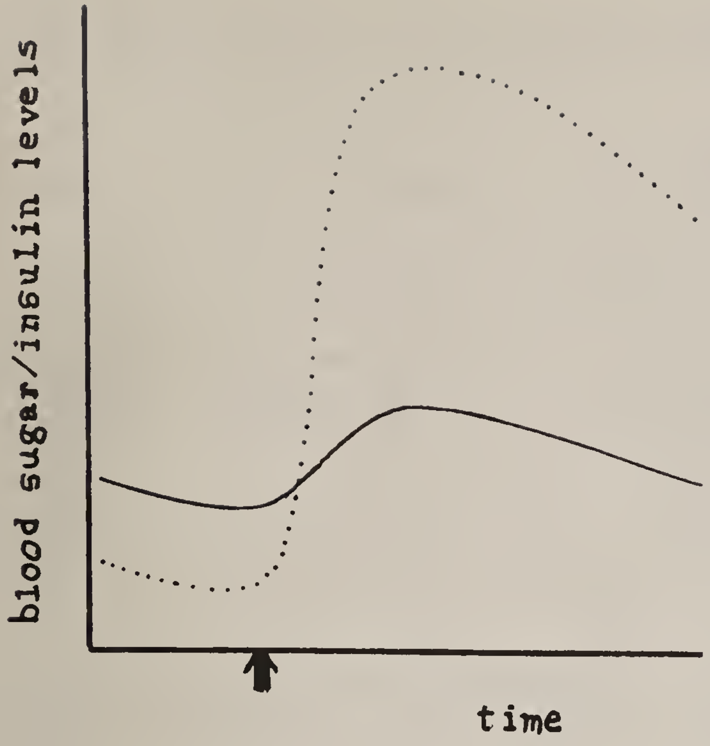


Figure 1 *Insulin/blood sugar variations in a non-diabetic at meal time. Note the very great variation in insulin level.*

In diabetes the blood sugar/insulin mechanism is impaired, and MAXIMUM POSSIBLE release of insulin is still not enough. Sugar stays in the blood rather than moving from there into the tissues where it is needed. It accumulates, sometimes to enormously high levels. Figure 2 diagrams this situation, and shows an insufficient supply of pancreatic insulin, as do all subsequent illustrations in this article. Insufficient SUPPLY of insulin, however, is not always the problem (see note 3).

The very high level of blood sugar shown in Fig. 2 means that sugar which should be reaching the body tissues is not. Tissues which thus remain essentially unfed continue to create a state of hunger. The person goes on eating, therefore, well beyond the point where he would normally stop. This is the condition called "polyphagia," or excessive eating, and it represents a state where the body is quite literally starving in the midst of plenty.

If this condition of starvation despite eating goes on for long, the person may eventually lose consciousness, entering the state called "diabetic coma." In coma the body is metabolizing its fat reserves very quickly in a desperate attempt to feed itself. Fat, however, does not metabolize cleanly; byproducts called ketones are created and these, as they accumulate, act like strong poisons. They may eventually cause loss of consciousness; if the person remains untreated, death is a possibility.

The opposite condition from diabetic coma, insulin reaction, or hypoglycemia, may also cause a loss of consciousness. Where diabetic coma follows upon a state of abnormally HIGH blood sugar, insulin reaction, however, follows upon too LOW a level of blood sugar. Insuln reaction can result from a variety of factors, including not eating enough food to "balance" the injected insulin, a sudden surge of unusual physical activity, or taking too much insulin by mistake. Although loss of consciousness can take place with insulin reaction, it is seldom a life-threatening crisis, and ample opportunity generally exists for the person to treat the reaction with sugar-containing food. That is all that's necessry—eating something with quick-acting sugar in it. Orange juice is excellent.

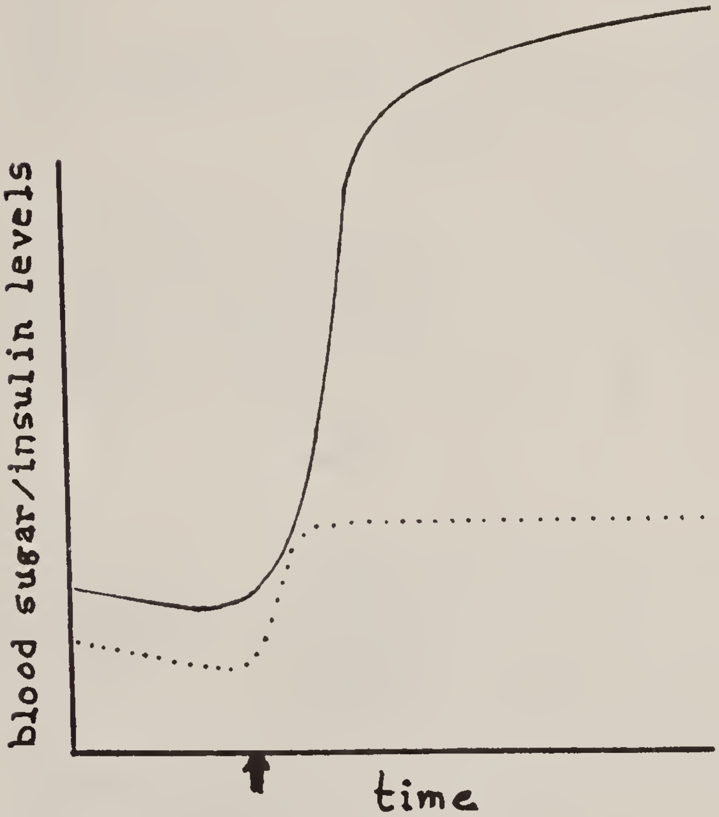


Figure 2 *Insulin/blood sugar levels in an uncontrolled diabetic. Note that as blood sugar begins to rise with food intake, so does insulin. Insulin rise, however, stops far short of the level needed, and blood sugar continues to rise to a much higher than normal level.*

Fig. 3 shows a possible course of blood sugar variations over an entire day in the case of an uncontrolled diabetic. Note that every time food is eaten (arrows) blood sugar simply goes higher, and afterwards falls only very sluggishly. As long as SOME pancreatic insulin is available so that body tissues obtain SOME of their needed sugar, coma will generally not occur despite what may be extremely high blood sugar.

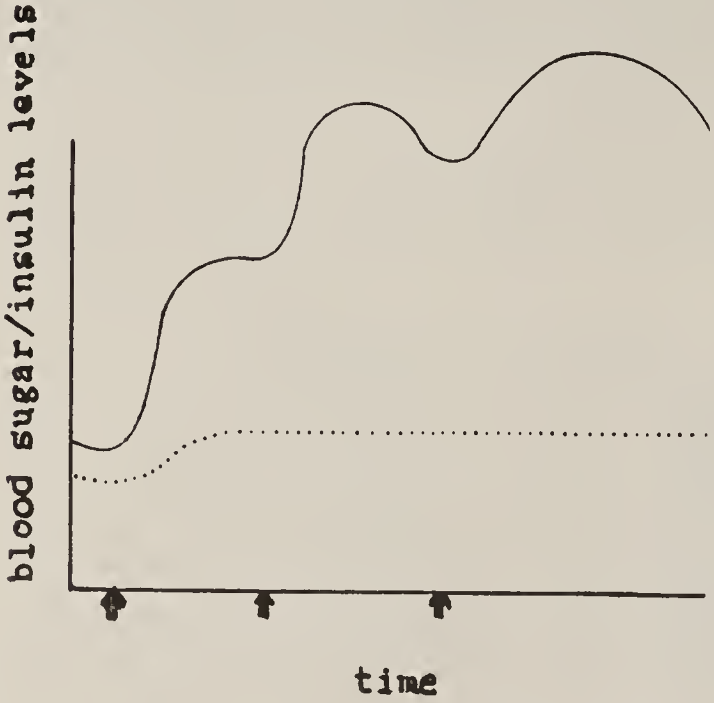


Figure 3 Possible blood sugar variations in an uncontrolled insulin-dependent diabetic. Note that an impaired pancreatic output is assumed here: food intake (arrows) has no effect on insulin supply, and blood sugars simply increase every time food is eaten.

When insulin first became available in the 20s, there was only one form of it: what we now know as "regular." This fast-acting, short-duration insulin, essentially the same as the insulin released by the body's own pancreas, needed to be injected three or four times per day to achieve control. While this kept alive many people who would otherwise have died, and while diabetics could then begin to live essentially normal lives, many did not welcome the need to inject themselves several times a day. Beginning in the mid 30s, therefore, a succession of time-release insulins came onto the market attempting to address this problem. PZI, NPH, lente, and other slower-acting insulin seemingly solved a major problem for many diabetics by making it possible for them to inject only one daily dose, instead of four. Eventually many new types of insulin found their way to the market and enabled physicians to pick whatever type seemed best for individual patients. Table I summarizes the types commonly available at present.

TABLE I: Types of insulin currently available with their characteristics of action.

TYPE & APPEARANCE	*ONSET*	*PEAK*	*DURATION*
Fast-acting			
Regular (clear)	½ hr.	2-4 hr.	6-8 hr.
Semilente (cloudy)	1½ hr.	4-7 hr.	12-16 hr.
Intermediate			
Globin (clear)	2 hr.	10-14 hr.	14-22 hr.
NPH (cloudy)	1 hr.	10-16 hr.	18-30 hr.
Lente (cloudy)	1 hr.	10-16 hr.	18-30 hr.
Slow-acting			
Protamine Zinc/PZI (cloudy)	6 hr.	14-24 hr.	24-36 hr.
Ultralente (milky)	5 hr.	20-26 hr.	36+ hr.

There seems to have been a widespread impression from about the mid-30s until quite recently that these time-release insulins had solved the diabetic's problem for all intents and purposes. This impression apparently grew stronger when oral medications became available in the 50s. Suddenly many people could get by without shots at all. Evidence was slowly accumulating, however, that all was not well with this "single-dose" insulin therapy. Distressing numbers of diabetics were experiencing one or more of the complications of the disease: nerve, kidney, and eye damage. Those who believed that very strict control of blood sugar could help avoid these complications gradually won their case. A major factor in the development of complications was eventually recognized to be chronically high blood sugars. And to some extent the long-acting insulins were responsible. Consider Fig. 4.

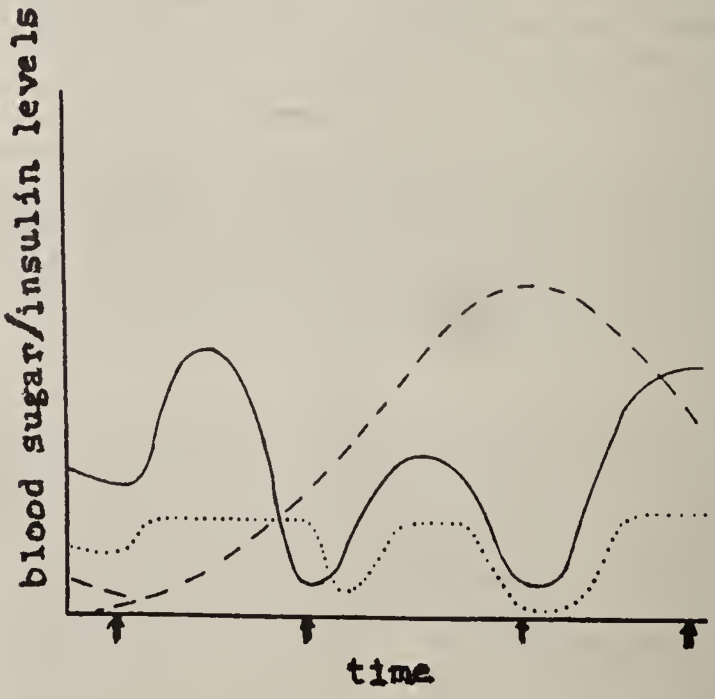


Figure 4 Effect of a single morning dose of long-acting (e.g., NPH) insulin on blood sugar in an insulin-dependent diabetic. Note the sharp rises in blood sugar in the morning (first arrow, breakfast) and evening (third arrow, supper; fourth arrow, bedtime snack).

In this illustration blood sugar is shown by the solid line and the impaired pancreatic insulin output by the dotted line as before. Injected time-release insulin (e.g., NPH) is shown by the dashed line. Note that even though the injection is taken before eating breakfast (the first arrow on the left), it does not begin acting to any significant extent until considerably later. After breakfast, therefore, blood sugar shoots up and doesn't fall until late in the morning. When it falls, it plunges, then stays reasonably low as it works efficiently with lunch (the second arrow). Supper—the third arrow—is generally eaten at a time when the injected insulin has begun to decline in activity. Since, in this country, supper tends to be the biggest meal of the day and to contain large amounts of protein and fat, this presents problems. The digestion of what tends to be a typical American supper will not be complete until after the injected insulin is nearly all used up. Digestion goes on, however, and blood sugar builds up. Adding to the problem still further is another American habit of nighttime snacking (the fourth arrow). Thus is is probably not at all uncommon for many diabetics to spend all night and a good part of the next morning with high blood sugars. And this despite frequent insulin reactions in the late morning and afternoon which incline them to think they're well controlled!! One physician has called this single-dose therapy, which was popular for decades, "...the worst thing that ever could have happened to diabetes...many juvenile diabetics who were on long-acting insulin for twenty years or more are now blind, sick, and dying."[4]

While single-dose therapy apparently is perfectly appropriate for some diabetics, apparently, for others it is a thing of the past. The original regimen from the 1920s of many daily injections of regular insulin has now, in effect, returned with the advent of the insulin pump. While its use is not yet widespread at this writing, it shows promise that it soon will be. The pump delivers its insulin not in a small number of large doses the way separate injections do, but in a large number of small doses, more like the way the pancreas functions. For many insulin dependent diabetics, the therapy that appears to best meet their needs is a multiple-dose regimen of mixed insulins. A typical daily routine of this type might involve a morning dose of, for example, NPH and Regular, and an evening dose of the same insulins in different amounts. The effects that can be achieved with this sort of therapy are shown in Fig. 5.

Here, the morning and late evening rises in blood sugar diagrammed in the previous figure are smoothed out by doses of regular insulin (dash/dotted line), with the longer-acting NPH dose (dashed line) taking care of the midday blood sugar. Blood sugar resulting from this therapy (solid line) shows gradual up and down waves staying more or less within normal limits. At any given moment the amount of insulin available for work is the SUM of the fractional doses of pancreatic, NPH and regular.

The problems facing the visually impaired diabetic, then, are how to measure accurately these often-complex doses of insulin, and how to monitor blood sugar levels. Technological advances, some very recent, have finally brought these problems within reach of a solution.

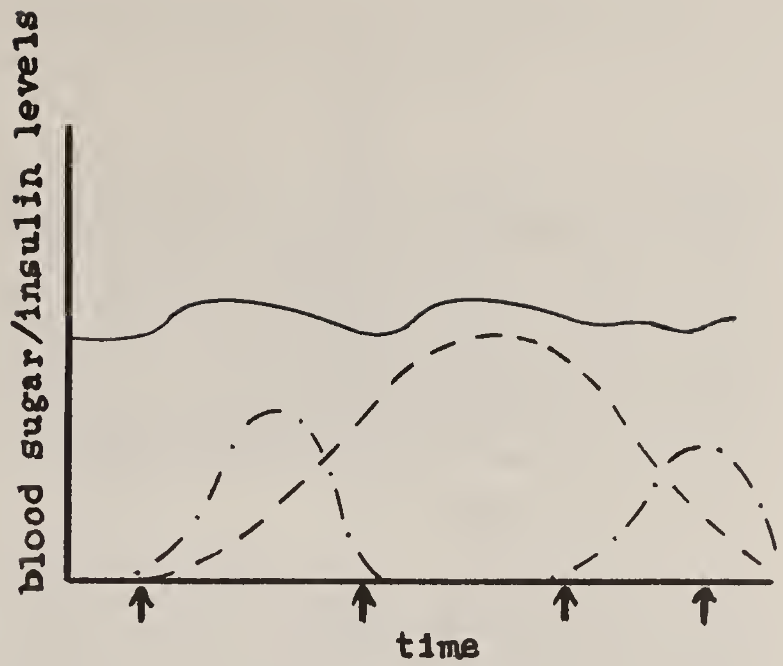


Figure 5 Example of multiple-dose therapy. Body's own pancreatic insulin is not shown for the sake of clarity. The doses of regular insulin before breakfast and again before supper fill in the gaps left by the NPH.

—— blood sugar
---- NPH insulin
–·– regular insulin
🠅 food intake

NOTES

[1] Cochran, H.A., Jr.; Marble, A.; Galloway, J.A. "Factors in the Survival of Patients with Insulin Requiring Diabetes for 50 Years," *Diabetes Care*, Vol. 2, No. 4, pp. 363-8, July-August, 1979.

[2] Krall, Leo. *Joslin Diabetes Manual*, Eleventh Edition. Philadelphia: Lea & Febiger, 1978, p. 5.

[3] In some cases the diabetic is observed to have a normal, or even above normal, supply of insulin. The problem appears to be that the body cannot use some of the insulin present in the blood. The reason for this is not fully understood.

[4] Goodman, Joseph. *Diabetes Without Fear*. New York: Avon, 1978. p. 28.

Basic Equipment for Insulin Administration

by

Ruth B. Carr, R.N.

In managing insulin administration, insulin and insulin syringes have served as basic equipment since 1922 when insulin, isolated from the pancreases of cattle or pigs, was first injected into humans for the treatment of diabetes mellitus. Even with recent developments in insulin delivery, such as the insulin pump, syringes and vials of pork or beef insulin remain the basic equipment. Much of the following discussion will prove familiar to those already acquainted with this basic equipment. However, it also contains a brief description of the "new insulins" which may bring to light some of the implications for their use in insulin administration with vision loss.

Commercial insulin is contained in a glass vial, permanently affixed with an aluminum cap, which is in turn centered by a tiny rubber diaphragm. The rubber diaphragm permits penetration by the hypodermic needle of the insulin syringe so that the insulin may be withdrawn and measured for injection. Insulin vials may have different shapes, but all insulin vials have the same spatial volume—10 cubic centimeters; they also contain the same volume of liquid—10 milliliters. For example, the Danish insulin Novo is sold in a tall, narrow vial in both Europe and the United States while American insulins (Lilly and Squibb) come in relatively squat vials; yet these vials all contain 10 milliliters of liquid in 10 cubic centimeters of space.

Even though all commercial insulin vials contain the same amount of liquid, concentrations of insulin within the total liquid vary. The insulin vial does not contain pure insulin but rather a portion of pure insulin, measured in "units," combined with other compounds in liquid form. Variations in concentration result from the fact that the amount of pure insulin combined with the other liquid in the vial can be increased or decreased compared to that other liquid. Therefore, all insulin vials are not only labeled to show the form of insulin contained (Regular, Semilente, Globin, NPH, Lente, PZI, or Ultralente); they are also labeled to indicate which of the three commercially available concentrations of insulin is contained.

Presently, the concentrations of insulin on the market are U-40, U-80, and U-100. The terms refer to the number of units of insulin incorporated in each milliliter of liquid: U-40 contains 40 units of insulin incorporated into each milliliter of total liquid in the vial; U-80 contains 80 units per milliliter; U-100, 100 units per milliliter. Clearly, the amount of insulin compared to the amount of liquid in which the insulin is mixed is greatest in a vial labeled U-100; in other words, U-100 insulin is the strongest commercially available insulin. In the near future, the only strength of commercially available insulin will be U-100; already U-80 insulin has been phased out.

The single available insulin strength should prove fortunate, since the availability of three different concentrations has been known to contribute to dosage error. Even though dosage error from this source may soon be a thing of the past, an explanation of it seems warranted since the problem could persist during the transition to the uniform concentration of U-100 insulin.

In order to understand the problem it is first necessary to know that each of the three concentrations has its own syringe, specially calibrated for that concentration only. To administer an accurate dose of insulin, *only* a U-100 syringe can be used with U-100 insulin; *only* a U-40 syringe can be used with U-40 insulin; and *only* a U-80 syringe was to be used with U-80 insulin. (As an alert, the different syringes are not only *labeled* according to concentration but also *color-coded:* a U-40 syringe is marked in red, U-80 in green, and U-100 in black.)

For an illustration of how dosage error can occur with the availability of various concentrations, consider how the standard 1 cubic centimeter syringe would be differently calibrated for U-100 insulin and for U-40 insulin. The figure below shows that the mark for a 20 unit dose of insulin is at the half-way point on the U-40 syringe, while on the U-100 syringe, the 20 unit mark is at a point 1/5 the total volume of the 1 cc syringe.

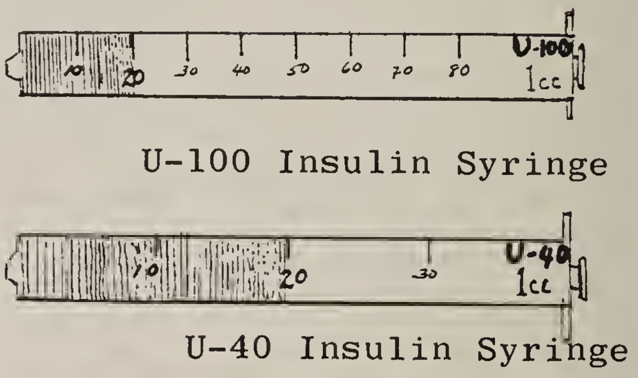


Figure 1

The relationship may be explained as follows: full, a 1 cc syringe of U-100 insulin would contain 100 units of insulin; to administer 20 units of insulin, then, the 1 cc syringe would be 1/5 full since 20 in 1/5 of 100. A 1 cc syringe full of U-40 insulin would contain only 40 units of insulin; thus a 20 unit dose of insulin using the U-40 concentration in a 1 cc syringe would be exactly 1/2 cc, making the syringe half-filled exactly. Now consider the possibilities of dosage error by mistakenly using a U-40 syringe to draw up U-100 insulin for an intended 20 unit dose. The 20 unit line on a 1 cc U-40 syringe would mark the halfway point, 1/2 cc; but 1/2 cc of U-100 insulin would be a dose of 50 units of insulin, more than half the intended dose of 20 units. Consequences of such a dosage errror are potentially serious. The need for using only the U-40 syringe with U-40 insulin and the U-100 syringe with U-100 insulin is obvious. Obvious as well is the point that uniformity of concentration will greatly reduce the possibility of these large dosage errors.

Other recent changes in insulin are worthy of note. In 1980, drug companies introduced what has been called "the new insulin." Processed beef or pork insulin (as is the "old insulin"), this new highly purified insulin contains significantly fewer impurities, considered by many physicians to cause side effects in the diabetic, including allergic reactions—a hive-like rash at the injection site; insulin atropy—loss of fat at areas of injection resulting in indentations or hollows; and immunologic insulin resistances—a rare condition almost always due to insulin antibodies. It is hoped that the use of purer insulin will contribute to decreasing these specific complications and to decreasing the incidence of diseases of the eye and kidneys which people with diabetes can develop. It is hoped that a similar contribution will be made by a synthesized insulin with an amino acid chain identical to that of human insulin; it is still in research.

These potential benefits of the "new insulin" stem partly from the fact that highly purified insulin is absorbed more rapidly and in some cases more thoroughly. The new insulins can thus prove more effective in lowering blood glucose levels; one result of using these products can be a decrease in the insulin dose required for glycemic control. But there are also potential hazards. It should be noted that any dosage error on the side of an unintended increase could have more pronounced capacity to send blood sugar levels too low, since both the more purified insulins and U-100 insulin are in effect stronger. For these insulins the exactness of measurement is at least somewhat critical. This caution is offered to point out the need for the diabetic with vision loss to have accurate devices and reliable techniques for measuring the insulin dose.

The availability of a new insulin product with the trade name Mixtard has been reported recently; it is on the shelf in larger, urban pharmacies. The insulin is composed of a stable mixture of 30% rapid-acting insulin and 70% intermediate-acting insulin. This premixed combination has potential use for those whose daily insulin injection consists of a so-called mixed dose. (Refer to "Diabetes: Some Physiological Considerations for the Blind Person," page 5.) Since measuring a mixed dose is more complicated than drawing up a single insulin, and since the procedure is further complicated by vision loss, it is possible that this product could prove useful. However, there have been cautionary comments by health professionals, who point out that this product would not permit the effects of the insulin dose to be monitored in respect of its specific components nor to be adjusted specifically for any changes in health or exercise. Yet those who believe they might benefit from this product should consult their physician. (The product is distributed by Nordisk USA; 7315 Wisconsin Avenue, Suite 851-W; Bethesda, MD 20014.)

Of course, for any contemplated change in insulin, the physician should be consulted. Insulin may be purchased from the pharmacy without a prescription; however, the basic form and daily dose(s) of insulin are originally determined and thereafter monitored by the physician.

In contrast to insulin, which is a nonprescription drug, the other basic equipment of insulin administration, insulin syringes, must be prescribed by the physician. The prescription specifies the type of insulin syringe which the person may purchase at the pharmacy. Generally, the insulin syringe consists of a sharp, hollow needle, through which insulin is both withdrawn from the vial to fill the syringe barrel and then injected into the body; the barrel, marked and calibrated for units of insulin; the plunger, which ends in a disk. The disk at the end of the plunger becomes an important component in measuring insulin without sight; it is referred to in Fig. 2 (and throughout this issue) as the plunger base.

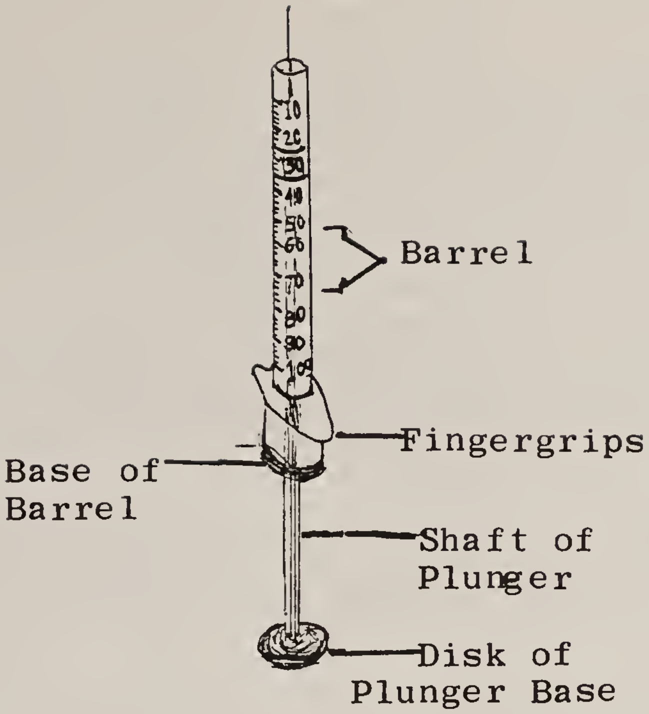


Figure 2

Before the introduction of plastic, disposable syringes, the basic device of insulin administration was the insulin syringe made of glass. But the glass syringes have several disadvantages. In glass syringes with removable needles, the hub, which holds the needle, creates so-called "dead-space"; here, up to 10 units of insulin may be hidden so that use of such syringes can result in dosage error. Other disadvantages include possible breakage, required sterilization with each use, and the eventual wearing away of the scale. Along with no possibility of dosage error from hidden insulin in the hub, plastic disposable syringes have other advantages: their fine-gauge needles are ultra-sharp for easy, comfortable insulin injection; they are pre-sterilized; and since they may be purchased in money-saving packs of quantities such as 10 or 100, they are economical. For these reasons, plastic disposable needles, for the majority of users, have replaced the glass insulin syringe.

Some gauges for measuring insulin without vision are designed for use with only certain brands and sizes of syringes. Thus it could be useful to know that for U-100 insulin there are two sizes of plastic disposable U-100 syringes and two sizes of reusable glass syringes. The two major manufacturers of insulin syringes, Becton-Dickinson and Monoject, each market a 1-cc disposable syringe and a .50-cc disposable plastic syringe; these syringes and their use with gauges for insulin measurement without vision are discussed in detail in "Measurement and Injection of Insulin by Blind or Visually Impaired Diabetics." Glass syringes also come in long and low dose sizes: 1-cc and .35-cc reusable syringes.

A final, useful product innovation requires mention: individually packaged alcohol wipes, for sterilizing the injection site, can replace the less convenient bottle of alcohol accompanied by cotton balls. In the East, Becton-Dickinson is a popular brand. Boxes contain 100 prepackaged alcohol wipes; price per box is currently less than $2.50.

This cursory description of the basic equipment used in insulin injection—forms of insulin and syringes—can, it is hoped, serve as background for the more particular explanations of "Devices for Insulin Administration with Vision Loss."

Insulin Gauges: Two Views

The two articles following present opposing perspectives on the evaluation and selection of insulin gauges. "Measuring and Injecting Insulin: Equipment and Techniques for Use by Blind or Visually Impaired Diabetics," by Joyce Schulz, R.N.,advocates the exclusive use of the Insulgage, which is commercially manufactured; the article discusses reasons for choosing this device over all others. The article not only details the advantages of the Insulgage, it outlines the disadvantages of homemade devices.

The second article, "Modifications on Insulin Techniques for the Visually Impaired or Blind Diabetic," by Alice Raftary, M.Ed., develops the argument on behalf of the homemade insulin gauge. In addition, instructions are provided for fabricating one from common, household materials, and suggestions for teaching the use of any device are given.

Though the two articles are opposed, both present equally valuable information, information which, we feel, can be useful regardless of one's agreement or lack of agreement with the overall point of view of either article. Our intention is *not* to encourage the reader to choose one approach over another. Rather, we juxtapose the articles in hope that their strong contrast will serve to highlight the kind and range of criteria used in evaluating and selecting insulin gauges for individual use.

Measuring and Injecting Insulin: Equipment and Techniques for Use by Blind or Visually Impaired Diabetics

by

Joyce Schulz, R.N.

Technique for Labeling Insulin

With vision loss, locating and identifying vials become problems for the diabetic; knowing the amount of insulin contained in the vial as successive doses are withdrawn becomes equally difficult.

A system for labeling insulin vials is needed if the individual is taking a mixed dose of insulin, i.e., a short-acting insulin such as Regular or Semi-Lente. The simplest and easiest way of identifying the specific type of insulin is to stretch a rubber band around the longer-lasting vial. Another method used by some is to braille an R on tape and tape it to the Regular insulin vial. A variety of methods of marking can be used; but whatever method is chosen, it should make sense to the person and should be consistent. For instance, the longer-lasting insulin should not be labeled one time, then the shorter-acting insulin the next time.

To determine when an insulin vial is empty, the visually impaired diabetic must first of all determine the number of safe doses available in a vial and then have a system for keeping a record of the number of doses injected. A standard vial has 10 cc of insulin solution—whatever the type, strength, or brand. If U-100 insulin is being used, this would therefore equal 1000 units of insulin. For safety's sake, it is best to allow approximately 60 units of insulin to remain in the vial or 0.6 cc of solution. This will insure that the tip of the needle will always be in some solution. Without the amount of remaining insulin solution, the tip of the needle can protrude into air within the vial when it is inverted for withdrawing the insulin. The individual should therefore assume that a new vial of U-100 insulin has only 9.4 cc of safely usable insulin or 940 units. To determine the number of safe doses in the vial, the person must divide 940 by his dosage. For example, if a person's dose is 30 units, he or she can count on 31 safe doses since 31 is the result of dividing 940 units by 30—the number of units of each individual dose. When the number of safe doses has been withdrawn, the vial can be discarded or set aside until such time as a sighted person is available to withdraw the remaining insulin and insert it into a new vial.

A system to record accurately the number of doses administered is also a necessity. The particular system used is not as important in itself as the necessity that whatever system is used make sense to the person. One system is to count out the number of syringes equal to the number of safe doses in the vial. When the syringes are used up, the vial of insulin would also be finished. Small-sized counters are another system that some people find convenient. For example, a number of marbles, buttons, or toothpicks equal to the number of doses can be placed in a container; when each dose is administered, one object is taken from the container so that the empty container will signify that all safe doses have been used. Likewise, straight pins or safety pins in a number equal to the safe doses may be first stuck into a strip of cloth and then removed, one for each dose administered. Or pills or vitamins can be counted out, one for each dose, and swallowed before each shot; for those who take these medications daily, this system works well. Some visually impaired and blind diabetics prefer to keep a daily written or braille record of their insulin status and find this means most accurate.

Sterilizing Equipment and Inserting Needle into Vial

The widespread use of disposable needles and syringes has done away with the need for sterilizing equipment and such techniques as soaking syringes in alcohol and boiling needles. Yet for the visually impaired diabetic, inserting the needle directly into the insulin vial rubber stopper without contaminating the needle remains a problem of insulin administration. Contamination usually occurs by hitting the metal ring surrounding the rubber stopper with the needle. For many years a metal funnel-shaped needle guide was the only device available to help direct the needle into the rubber stopper. However, many people can still encounter problems with the needle hitting the side of the needle guide; if the needle guide is not itself sterile, the needle can become contaminated.

The Holdease Needle Guide and Syringe/Vial Holder, manufactured by Meditec, Inc., is a device available for solving this problem. The insulin vial snaps in one end, and the insulin syringe in the other so that the syringe needle slides directly into the insulin vial through the rubber stopper. There is no other material in its path to cause contamination.

Drawing and Measuring Insulin

Over the past several years a variety of devices to assist in self-measurement of insulin has been marketed; these devices vary with respect to safety and accuracy. Before determining which aid to select, some consideration needs to be given to the suitability of using disposable insulin syringes with any kind of volume regulator or precalibrated loading device.

There are various brands of disposable syringes—the three major brands being B-D, Monoject, and Jelco. Each of these manufacturers makes insulin syringes in several types—long, short, attached needle, lo-dose, etc. Each brand/type is different in its exact shape and dimensions.

During production the syringe manufacturers have careful control only over certain syringe dimensions such as the barrel of the syringe. A consistent dimension to each barrel of the syringe is necessary for accuracy when it is filled visually in the traditional method. Other parts of the syringe, specifically the plunger, play no part in the accuracy of the dosage measured and withdrawn using sight. These are of no concern to the manufacturers and are not necessarily checked. However, when a volume regulator such as Dos-Aid or pre-calibrated loading device such as the Insulgage loading gauge is used to measure insulin, the length of the plunger becomes equally important for an accurate dosage. It should be understood that only those brand/types of disposable syringes whose production characteristics are such that maximum variations of those parts affecting accuracy are sufficiently small should be selected for use with pre-calibrated or volume-regulating devices.

According to information from the manufacturer, the Monoject long 501 syringe is definitely not suitable and should not be used with any type of device.

Varying dimensions for the syringe plungers of different manufacturers can also make for hazards with homemade gadgets and devices commercially available. One of the generally unrecognized hazards with homemade gadgets and many of the volume regulators on the market is the capability of using various disposable syringes in the same device. Medication errors can result if the regulator has been pre-set or pre-cut for one brand/type of syringe and another brand/type of syringe is used. This can happen frequently because of special sales on syringes. The person can change his or her brand of syringe for economic reasons alone without foreseeing other consequences. Unless the person has been instructed and cautioned about the variances in brand/types of syringes, he or she may unknowingly measure up an amount of insulin with a device that has been pre-set to measure the specific dosage with another brand/type of syringe.

When selecting a particular device to aid in self-measurement of insulin, the essential aspects to consider are:

i. Is it safe? Is it possible to interchange various brand/types of syringes in it?

ii. Is it accurate?

iii. Can it be read by the visually impaired or blind diabetic so that he/she is not tied in to a sighted person for pre-setting the device each time his/her dosage is altered?

iv. Can a mixed dose be safely and accurately measured?

v. Is it simple and compact?

The one device on the market at the present time that meets all these needs is the Insulgage loading gauge manufactured by Meditec, Inc., Englewood, Colorado. My experience suggests that the Insulgage loading gauge in combination with the Holdease Needle Guide and Syringe/Vial Holder provides the visually impaired or blind diabetic with a safe, accurate means of measuring his or her insulin.

When actually drawing and measuring insulin, a concern many visually impaired diabetics and some professionals have is the possibility of drawing and injecting a large amount of air instead of insulin. Consistent use of proper techniques for filling the syringes assures safety in this area. There is also less chance of large bubbles being drawn up by using disposable syringes with attached needles. This is because of reduction of dead air since the hub of the needle has been eliminated. Reassurance should also be given that a large air bubble injected sub-cutaneously will not cause any damage, the only concern being that a large bubble of air will replace units of insulin, producing a medication error. A small pinpoint bubble of air is of no concern.

Specific instructions for drawing and measuring insulin with use of the Insulgage loading gauge and Holdease are as follows:

Dose of Single Insulin

(1) Rotate insulin vial between palms of hands to mix insulin.

(2) Wipe rubber stopper of insulin vial with alcohol wipe.

(3) Insert vial into Holdease—snap vial into large opening and slide inward until metal cap is against center divider.

(4) Insert syringe in Holdease—grip syringe near needle end, twist off needle guard and press syringe into clip through top opening.

(5) Pressurize vial—to correctly pressurize vial an amount of air equal to the insulin dose needs to be injected into the vial before solution is withdrawn. To achieve this, hold the gauge so that the slotted end is down. Place the slot in the gauge over the head of the plunger. Pull down with the gauge to withdraw the plunger, while pressing it lightly against the syringe. Remove gauge. Slide syringe lightly toward vial until stopped. Position holder with vial down and insert air into vial.

(6) Fill syringe—turn holder to upright position with vial on top. Grip syringe any comfortable way and pull plunger back about one finger's width—then push insulin back into vial. Repeat this procedure two more times—this is done to clear bubbles. With plunger pushed all the way in again, place the slot in the gauge over the head of the plunger. Pull down with the gauge to withdraw the plunger while pressing it lightly against the syringe. Pull the plunger out until the gauge fits between the plunger head and the end of the syringe. You can feel the gauge slipping in to fit over the disk plunger base. Then pull the plunger out a bit more—about 2 or 3 units. Now push the plunger in with the gauge as far as it will go. Note: In this final correctly loaded position, the disk of the plunger base should be firmly against the back of the slot in the gauge.

(7) Slip the gauge off the syringe. Slide syringe in clip until needle is completely out of vial. Turn needle end up to lift syringe out of clip.

Mixed Dose of Two Insulins

Two gauges are needed: see step (4) below.

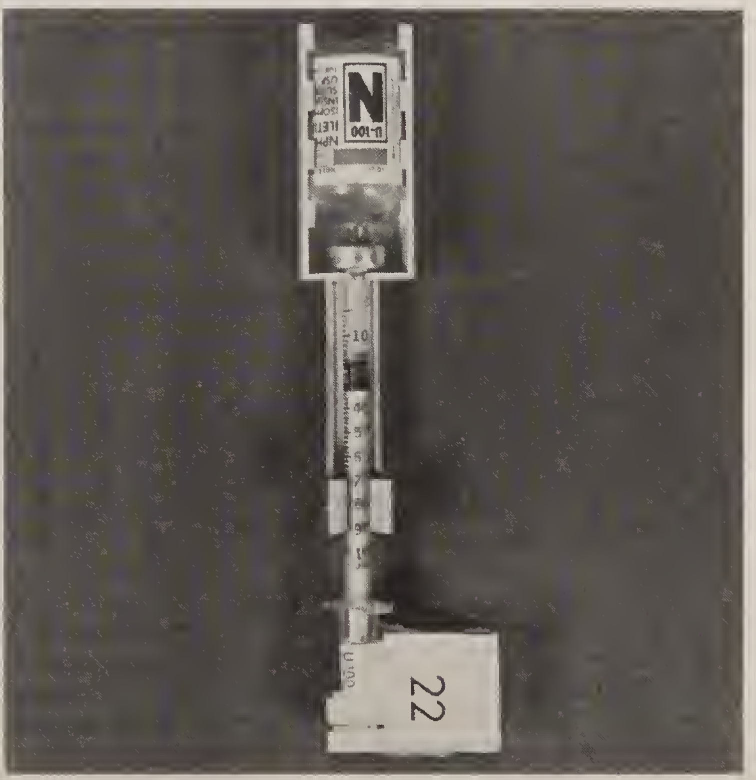
(1) Pressurize vial of longer-acting type of insulin. Follow steps 1 through 3 for *Dose of Single Insulin* above; then slide needle out of vial without removing syringe. Slide vial of insulin out of holder.

(2) Fill syringe with shorter-acting type of insulin. Insert vial of shorter-acting insulin, pressurize it (step 5) and fill syringe (step 6).

(3) Change insulin vials in holder. Slide needle out of vial but leave syringe in clip. Slide out vial of short-acting insulin and insert (pressurized) vial of longer-acting insulin.

(4) Fill syringe with second type of insulin. Slide needle into vial and fill to prescribed total dosage (step 6). Note: The size of Insulgage used for the longer-acting insulin should be equal to the total insulin dosage since it will be added to the short-acting insulin already in the syringe, e.g., 4 units Regular insulin plus 16 units NPH insulin = 4 unit Regular gauge plus 20 unit gauge for NPH insulin.

(5) Remove syringe.



Injecting the Insulin

Insulin injection techniques are the same for the visually impaired diabetic as they are for the sighted diabetic with two exceptions. When injecting insulin, the person should stabilize the hand holding the syringe by placing the little finger against the skin as a point of reference and inserting the needle at the skin surface. This differs from the sighted technique of inserting the needle with a jab like throwing a dart.

After inserting the needle it is not necessary to pull back on the plunger to check for blood. Reassurance may be needed that this in no way endangers the person. This may be a step that the person has previously been taught is essential. When using proper technique and insulin injection sites, the probability of injecting into a blood vessel is remote. If this should occur, the only result would be a quicker absorption of the insulin.

Injection Technique:

(1) Wipe off the injection site with alcohol wipe.

(2) Pinch up the area where the needle will be inserted between thumb and fingers of free hand. Pinching up the area will pull the fat away from the muscle and the injection will then be into the fat. To pinch up the area on the arm, press the back of the upper arm against a chair back or corner of wall. Roll the arm down.

(3) Insert the needle as instructed above.

(4) The skin may also be spread between the fingers and needle inserted straight up and down in areas where there is more fat.

(5) Let go of the area and push in plunger.

(6) Place the alcohol wipe over the needle and pull needle out. Press wipe over the area for a few seconds.

Locating and Rotating Sites for Injection

Insulin may be injected in any area that has a thick layer of fat and is free from large blood vessels and nerve. Areas that may be safely used are the upper arms, thighs, buttocks, and abdomen. To locate the areas that are safe for injection of insulin, the following procedures may be used by the visually impaired diabetic.

To locate the injection site on the upper arm, place the heel of the right hand where the left arm joins the shoulder. With the right hand thus anchored, extend the middle finger to draw an imaginary line across the top of the upper arm. Then place the right hand, heel down, on the left elbow, extend the middle finger, and draw an imaginary line across the left upper arm with the right middle finger. The middle and outer area of the upper arm between these two imaginary lines may serve as an injection site. To use the right upper arm, reverse left and right in the foregoing instructions.

To locate the injection site on the thigh, place the left hand, heel down, on the left hip bone and draw a line below the point where the middle finger rests. Then place the left hand at the bottom of the thigh with the middle finger just touching the knee cap; use the fingers of the right hand to draw a line across the thigh where the heel of the left hand rests. Use the middle and outer area of the thigh between the two imaginary lines for insulin injection. To use the right thigh, reverse left and right in the foregoing instructions.

To locate injection sites on the abdomen, place the heels of the hands on the lower ribs and draw a line using the middle fingers. Place hands on hip bones and draw a similar line. Use the area between these two imaginary lines as far as you can pinch up fat. Do not use the belt line or a one-inch area around the navel. If there is enough fat to pinch up, the buttocks may also be used.

It is important to rotate or alternate these injection sites from dose to dose, day to day. If one site is used repeatedly without days intervening between injections, then the fatty tissue will change in ways that can interfere with absorption of the insulin. On the other hand, if a completely unused site is suddenly used, then the insulin may be absorbed too well, too quickly, causing insulin reaction. Site rotation is important in the prevention of both these problems.

REFERENCES

Isenberg, Joel S. "Self-administration of Insulin by Visually Impaired Diabetics." Meditec, Inc., Englewood, Colorado.

Isenberg, J.S. "Disposable Insulin Syringes — Suitability for Use with the Insulgage Gages." Meditec, Inc., Englewood, Colorado.

Nursing Skillbook: "Managing Diabetics Properly," Intermed Communications, 1977.

Modifications on Insulin Techniques for the Visually Impaired or Blind Diabetic

by

Alice Raftary, M.Ed.

A simple, homemade volume regulator for measuring insulin can be constructed from a row of staples; for the diabetic who is suffering a visual loss, even temporarily, it can provide a means of coping with a lower level of acuity. The templet measurement technique ought to be introduced at the time of initial visual impairment, since the procedure is most easily learned when useable vision remains. Not only the measuring technique can be learned at this time, but also the method for constructing the templet. These techniques, once learned, become a part of motor memory and can be used in any case of vision impairment—even total blindness. The templet technique is thus to be preferred to the use of magnifiers because it can provide a permanent solution to the problem of accuracy in insulin draw.

Making the Templet

Simply and economically, a templet of refill staples and a soft adhesive tape (masking, mystic, surgical, etc.) can be made; made according to the following procedure, it will be accurate. Set the insulin dose on the syringe. Break off a length of staples slightly longer than the length of exposed plunger. Remove a few staples at a time, until the length of staples fits snugly between the exposed plunger end and the syringe barrel. Wrap the length of staples, including one of the angles, with tape to insure permanence and rigidity. Check the accuracy of the templet.

Advantages of the Staple Templet

The chief advantage of this homemade device is its ready availability. If there is a prescription change or a templet has been lost, a homemade templet can be made on the spot. This templet is easy to construct and the inexpensive materials are found in most homes and office settings. For example, if one needs a template made when in a motel, the length of staples and the few inches of tape would be freely provided by the desk clerk. On the other hand, the commercial aids are infrequently available at pharmacies and mail-orders may require 6-8 weeks for delivery. Although their ready availability, freedom from cost, and ease of assembly make staples the preferred material for a homemade templet, other materials, e.g. plastic or metal tubing, will also work.

Important Note

A new templet is necessary when there is a change in the amount or type of insulin prescribed; when there is a change in the manufacture or model of the syringe to be used by the patient; if it becomes raggedy after much use.

Disposable syringes should be used since the plunger of the plastic disposable syringe is easier to control.

Technique for Drawing Up Insulin

—Assemble all equipment on a small, shallow tray or box.

—Mix insulin by rolling the vial gently between the palms of the hands.

—Cleanse the vial cap with an alcohol swab. Return swab to tray.

—Uncover the needle. *After the needle is uncovered, the syringe does not leave the hands until it is ready for disposal.*

In the dominant hand, hold the syringe near the needle hub as a pencil. With the other hand, hold the insulin vial firmly upright on the table, thumb and forefinger at the neck of the vial.

As the needle is brought to rest across the vial top, the free fingers of the hand holding the syringe will help locate the vial and steady the hand.

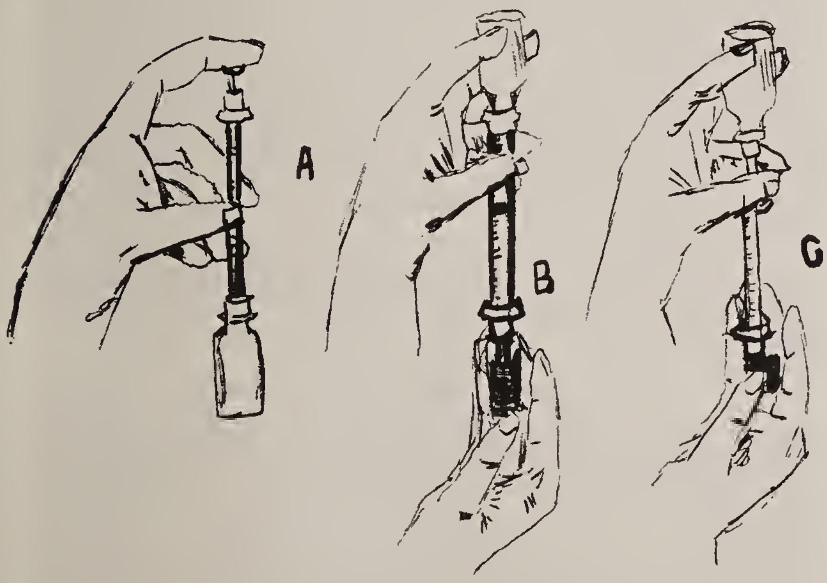
Draw the needle across the vial cap. There will be a small "click" as the tip comes off the metal ring onto the rubber. Rotate the syringe to the perpendicular and insert it into the vial. If the needle is not on the rubber, there will be resistance. Don't force it, as the needle will bend. Start over.

—Draw air into the syringe to the amount of the insulin dose by placing the templet along the shaft of the plunger and seating it snugly. Remove the templet and return it to the tray for easy relocation.

—With the vial resting firmly upright on the table, insert the needle. Expel the air into the vial.

—Slowly invert the vial with syringe attached. Hold it in a vertical position in one hand, leaving the dominant hand free to manipulate the plunger. Keep the equipment in a vertical position until the insulin is fully drawn. (Figs. B and C)

—With the dominant hand, pull out the plunger approximately 1/4" farther than necessary to insert the templet. Position the templet along the plunger shaft. (Fig. B) Push the plunger up so that the templet is seated. The insulin in the syringe is the dosage prescribed. (Fig. C)



Additional Procedures for Two Insulins in a Single Dose

—Make two templets. One templet should be made to measure units drawn first. The other templet is the length of the combined dose. Be sure the insulins can be differentiated tactually (e.g., a rubber band around one of the vials).

—Draw up air with the longer templet to the combined dose.

—Remove templet and insert needle in vial of insulin to be drawn second.

—Place the small templet along the shaft of the plunger, and expel air into the vial until the small templet is seated.

—Withdraw syringe with templet still in place.

—Insert needle into the vial of insulin to be drawn first.

—Remove templet and expel air.

—Draw up the first part of the dose, following the procedure described in the previous section.

—Remove the needle from the vial, keeping the templet in place. Return the vial to the tray.

—Keeping the templet in place, insert the needle into the second vial.

—Invert the vial, and remove the small templet, drawing up a few units.

—Set the longer templet with the end resting on the end of the plunger, and carefully pull out the plunger, steadying the templet with the thumb until the templet drops into place and is seated. (Fig. C) Do not expel any insulin back into the second vial.

—Withdraw the syringe from the vial with templet in place. If extra insulin was drawn, discard it by seating the templet.

—Remove the templet and proceed with injection.

Instructing the Blind Patient

CAUTION! This is not a complete insulin instruction. It is concerned with technique modification and presumes a considerable knowledge of diabetes and insulin management. Persons with a non-medical background should use this article with the consultation of an experienced nurse or clinician. Improper interpretation of insulin prescription can have serious consequences. It should be noted that insulin is a potentially lethal drug. In instructing the blind diabetic in the use of devices for nonvisual measurement of insulin, remember to consider his or her physical tolerance, mental alertness, etc.

ORGANIZE instructions and instructional materials thoroughly. Be consistent. Repeat instructions in the same terms and sequence. Be sure the patient understands the terminology you are using.

POSITION the patient. If the task to be learned is one he or she performed before, have the patient assume the familiar and comfortable position. If it is a new task, put the person in the posture best for him or her.

PROVIDE AMPLE TIME for the person to become familiar with the task. Have the person examine and manipulate thoroughly all materials and equipment used. Let the person observe and examine your demonstration tactually as you give verbal instruction.

INDIVIDUALIZE INSTRUCTION. If the person has had previous experience with the skill being taught, allow him or her to demonstrate present proficiency. Begin instruction at this level.

Experiment with possible adaptations and alternatives, e.g., other techniques of manipulation and/or use of assistive devices. Use short, frequent instruction periods. Do not rush instruction. Make sure that each step of the procedure is mastered before going on to the next step. Supervise the practice until you are reasonably sure that the patient will not be practicing an incorrect technique.

BE PRAGMATIC in your evaluation. Accomplishing the task is more important than the style of performance. Give plenty of positive reinforcement. (Nothing succeeds like success!) At the same time, be realistic and don't try to "con" the person.

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With the use of sight, the insulin dose is measured by reading the scale printed on the syringe barrel. The insulin vial is first pressurized so that the liquid will flow easily and smoothly when it is withdrawn into the syringe. To then withdraw the proper amount of insulin, the pressurized vial, with the syringe inserted, is inverted, the syringe plunger is pulled halfway down the syringe barrel, and a column of insulin half the length of the syringe is drawn up. To measure the exact amount for a particular dose, the plunger is then pushed in expelling excess insulin until the plunger head is observed to align with the scale marking for the desired dose.

Mechanical characteristics of the syringe itself, rather than the printed scale, can be used to accomplish the same procedure. The distance between the plunger base, pulled out from the barrel, and some fixed point on the barrel itself, for instance its base, will stay constant for any specific dose drawn. (Refer to Figure 2 on page 7.) Devices for nonvisual measurement of insulin all work according to this principle: that is, insulin gauges, including those volume regulators built into the syringe itself, control the distance between the base of the syringe barrel and the base of the plunger—they fix the distance to which the plunger can be pushed or pulled, or they tactually or aurally indicate it. The height of any given column of insulin drawn up in a specific number of units will always correspond to a fixed distance between the plunger base and syringe base of a particular syringe or of a syringe with the *exact* dimensions—thickness of plunger base, etc. As Joyce Schulz points out, it is thus crucial always to use the same brand and model of syringe with a particular preset insulin gauge and to use only those brands and models of syringes in which dimensions are consistent from syringe to syringe.

Devices called needle guides can be equally essential in nonvisual insulin administration. Needle guides, as the name suggests, aid in centering the hypodermic needle on the vial's rubber stopper. Some needle guides also hold the vial and keep it steady.

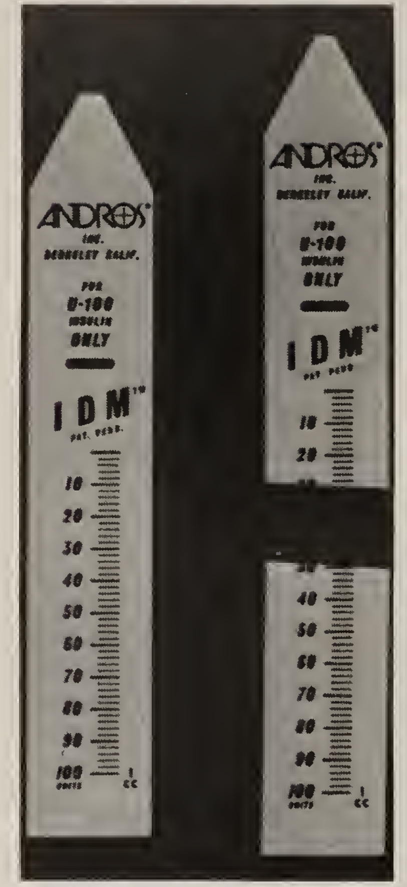
Magnifiers constitute another category of devices for insulin administration with vision loss. For some persons with remaining useable vision, hand or spectacle magnifiers can aid in both tasks—guiding the needle to the vial stopper and measuring the insulin dose in the syringe. While these magnifiers make all features of syringe and vial appear larger, magnifiers designed to attach to the syringe itself enlarge the lines and numbers of the unit scale only.

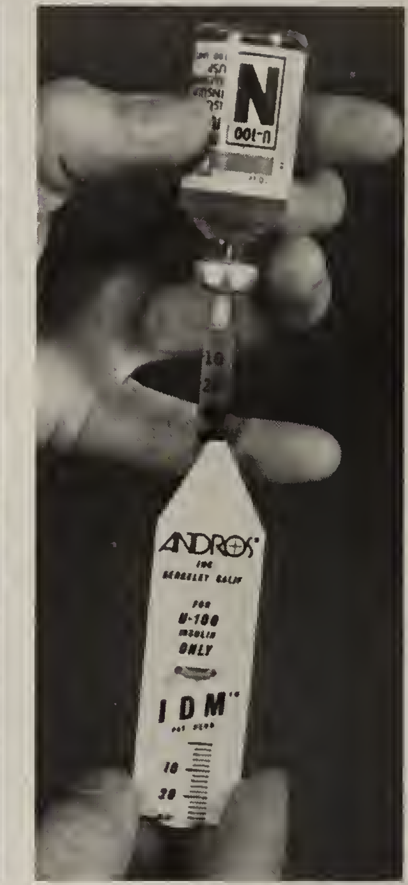
From our survey of rehabilitation and health professionals and of consumers, all of these devices would appear to have potential advantages and limitations. The appropriateness of any device ultimately depends on the particulars of a person's individual characteristics and circumstances of daily life. The following guide compiles descriptions of the devices with comments on their utility under various conditions.

For participating in the survey, we would like to thank in particular Ruth B. Carr, Richard M. Connors, Davide Marletta, Laura V. Marletta, Judith W. Oehler, Alice Raftary, Joyce Schultz, and Allene R. VanSon. We are also most grateful to Brian Collins of Toronto, Canada, for supplying not only valuable information but also some actual equipment purchased from the Canadian National Institute for the Blind. While some comments are not attributed to individuals, lengthier discussions bear the initials of their principal author.

Insulin Gauges

Andros IDM





Measures 1″ x 4″. Made of stiff but thin and flexible sheet plastic. Unit scale is printed the length of the gauge. Above unit scale is cut a slot for syringe's fingergrips. A nurse or physician is to cut the gauge at the unit line corresponding to the prescribed insulin dose. During use, the fingergrips of the syringe fit into the slot with the needle extending upward and over the gauge's arrow-shaped head. Then the plunger is pulled until the disk of the plunger base snaps past the edge of the gauge, already cut for the desired dose. The plunger is then pushed in until the disk is in contact with the edge of the gauge to set the dosage.

Essential features: For use with Becton-Dickinson's #8409 Plastipak U-100 disposable syringes *only*. Unit scale calibrated in 2-unit gradations.

Advantages: Scale is precisely calibrated and consistent for individual gauges. The slot fot syringe's fingergrips is precision cut to admit only the Becton-Dickinson #8409 Plastipak U-100 disposable syringe, for which the scale is calibrated—an effective safety precaution.

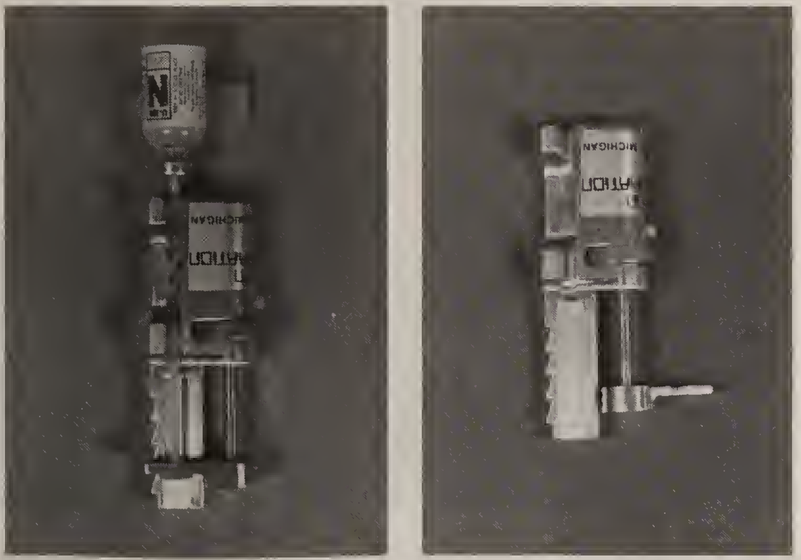
Disadvantages: Flimsy. Can be difficult to hold firmly while withdrawing plunger of syringe—also difficult to teach because there is no clear-cut step-by-step technique for solving this problem. (J.W.O.) Flexibility can cause dose to be off by several units if force is applied during measurement; ability to bend inspires mistrust. (B.C.) Can be quite difficult to cut evenly at proper unit line. Cannot be set by the visually impaired user. The 2-unit gradations of the scale make measuring odd numbered doses less accurate. Single IDM cannot be used to measure mixed doses or to change dose.

Solution: Several gauges may be ordered: one for intermediate acting insulin, one for combined dose of intermediate and regular insulin to accomplish mixed dosage. Others may be ordered and cut for predicted dose changes.

Independent Living Aids
11 Commercial Court
Plainview, NY 11803

Price: $3.50
Order No.: 074300

Cyberon Adjustable Gauging Device



Measures approximately 6″ x 2″. Prototype machined from metal alloy. Production models will probably be injection molded plastic. The central body of the device is basically rectangular with a "tongue" extending from body at lower left corner. A trough is machined on face along left edge above "tongue." This trough will accept the syringe barrel while a horizontal slot at base of trough will hold the syringe fingergrips.

During use, the syringe is held in trough by friction. The plunger extends from body of the gauge and down the "tongue." A threaded rod screws into base and through a thumbwheel fitted into body of gauge; at the base of this rod is a metal "flipper" that can be swiveled to hook over plunger shaft so that outside edge of flipper pushes against inside edge of the plunger base disk. Each full revolution of the thumbwheel moves the "flipper" a distance equivalent to one unit on the syringe. The thumbwheel is indexed so that it clicks each time a revolution is completed in the forward direction that increases dosage. In the reverse direction, no click is audible, but a resistance is felt when the revolution is completed. Notches cut into the left side of the "tongue" indicate tactually 10-unit increments as a guide to the dosage. The gauge may be preset before the needle is inserted into the vial; the plunger is pulled to draw up excess insulin, then pushed to expel excess back into vial until "flipper" stops movement at correct dose. Or the gauge may be set with the needle already inserted, a procedure which will pull out the plunger, filling the syringe gradually, one unit per turn of the thumbwheel. Because dosage setting is thus adjustable independently by user at time of use, device is suitable for measuring mixed doses of insulin. The physical design of the gauge allows the syringe to remain in the gauging unit while injection is administered.

A patent application has been filed on this device, and Cyberon Corporation is presently exploring a variety of methods for manufacturing, marketig, and/or licensing this device. (For further information, contact Eliot Friedman, President of Cyberon Corporation, at the address below.)

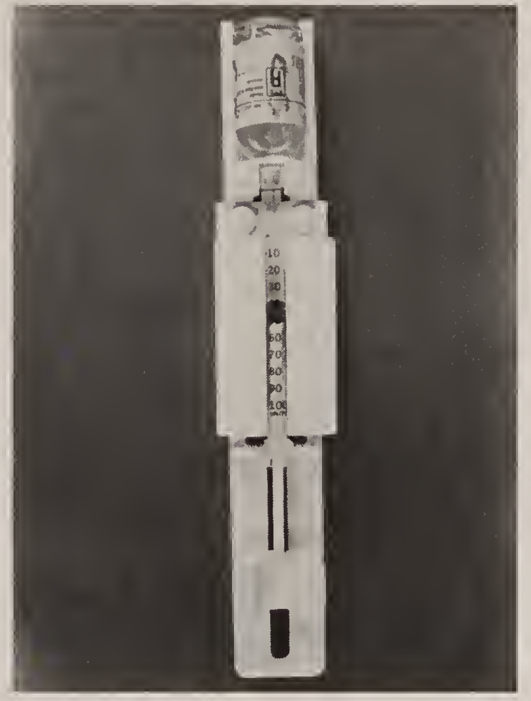
Essential features: Prototype has been machined in two models: one to fit B-D Lo-Dose U-100 syringe, one to fit Monoject Lo-Dose U-100 syringe. In production, one model may be developed to accept either brand of disposable 1/2 cc syringe.

Advantages: Accurate. Beautifully machined. Ingenious and functional design.

Disadvantages: Setting the device can seem to require a good deal of time—30 seconds to several minutes per injection. During this time, holding insulin vial steady can be a problem. Count of clicks can be lost without high degree of concentration, good hearing, tactual sensitivity.

Cyberon Corporation
1175 Wendy Road
Ann Arbor, MI 48103
(313) 994-0326

Dos-Aid Syringe Filling Device



Measures 7″ x 1 1/2″. Made of rigid plastic. The two-inch cradle at top holds insulin vial; attached by screws it is allowed to slide on main body of guide. The vial cradle is moved up or down to lengthen or shorten distance between insulin vial and syringe to adjust to specific syringe type. The middle consists of two blocks, side by side, with a vertical gap between them to hold the syringe barrel. Amount of separation adjusts to fit girth of specific syringe type. At the base of these blocks is a slot for the syringe's fingergrips. The bottom third of the device holds a block which can slide forward or back to set the guide for the desired insulin dose. To set, the syringe barrel rests in the syringe trough between two middle blocks with fingergrips in the fingergrip slots. The plunger is withdrawn to desired dose and the plunger stop (block) is pushed to rest against the disk of the plunger base. The screws are tightened. Now the block controls the distance to which the syringe plunger can be pulled and thus determines the insulin dose which can be drawn up. To be set by a health professional.

Essential features: Designed to measure single dose only. Designed for use with 1 cc syringes only; cannot be used with lo-dose syringes since even the closest position of vial cradle is still too distant for any lo-dose syringe to reach.

Advantages: Convenience of having vial holder, needle guide, and insulin gauge in one unit. Easy to locate and handle because of large size. Useful for limited dexterity such as that caused by one-handedness or severe neuropathy. (R.B.C.)

Disadvantages: Bulk makes it cumbersome to carry around daily. Screws can loosen and settings can change without user's awareness. Must be preset by sighted help. The use of various brands/types of syringes is not absolutely prevented. The slot for syringe fingergrips is wide enough to accommodate any brand or type of syringe, potentially causing dosage error. Dosage error can also result from ability of syringe to jostle in trough. (J.N.S.)

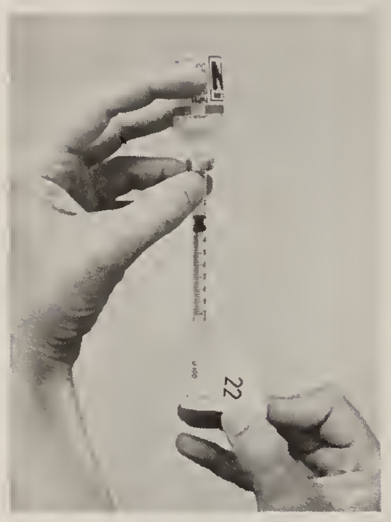
Solutions: Engineers at the American Foundation for the Blind are presently working on an improved Dos-Aid. Now in prototype, the device would have the capability of measuring a mixed dose, indicating automatically when the insulin vial is empty, and permitting the insulin dose setting to be varied at will.

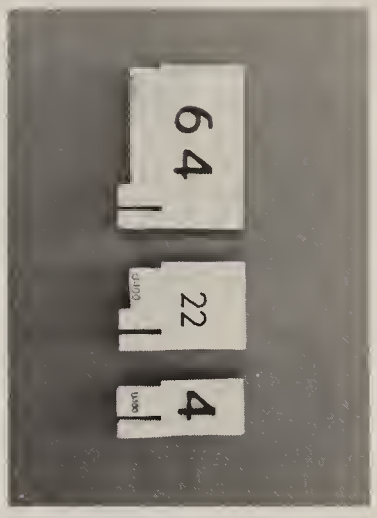
American Foundation for the Blind
Consumer Products Department
15 West 16th Street
New York, NY 10011

Price: $17.95
Order No.: NES-563

Centre Louis-Hebert Inc.
1270 Chemin Ste-Foy (4e Etage)
Quebec - G1S 2M4
Tel.: (418) 687-3470

Insulgage Loading Gauge





Measures 1 5/8″ in width. A 1/4″ thick rectangle, the height varies according to insulin dose for which the gauge is calibrated. High quality, durableplastic. Individual gauges are cut to length by manufacturer; the length corresponds to distance between the base of syringe plunger and the base of syringe barrel for a specific insulin dose drawn by a Becton-Dickinson Plastipak #8409 Long U 100 Syringe only. Gauges are produced in sizes ranging from 4 units U-100 insulin to 85 units; within this range, sizes are available only for even numbered units or for numbers of units which are multiples of 5. For mixed doses and anticipated dose changes, a variety of gauges may be ordered.

During use, the shaft of the syringe plunger fits into the hollowed-out vertical edge, and the disk of the plunger base slips into the horizontal notch. (Refer to "Measuring and Injecting Insulin" on page of this issue.). Body of gauge contoured for firm grasp. Face of gauge labeled with insulin dose, choice of media: black large print numerals; 1/2″ tall, raised plastic numbers; or braille. Both braille and raised numbers are also available.

Essential features: For use with a Becton-Dickinson Plastipak #8409 Long U-100 syringe only.

Advantages: Normal hand-motor control is adequate dexterity for use; neuropathy does not significantly interfere with technique. Mixed doses can be measured with use of 2 gauges—one for short-acting insulin and one for combined dose of short-acting insulin and intermediate-acting insulin. Simplicity and sturdiness of device makes practical the techniques of injecting regular insulin before each meal for tight control. (D.M.) (J.W.O.)

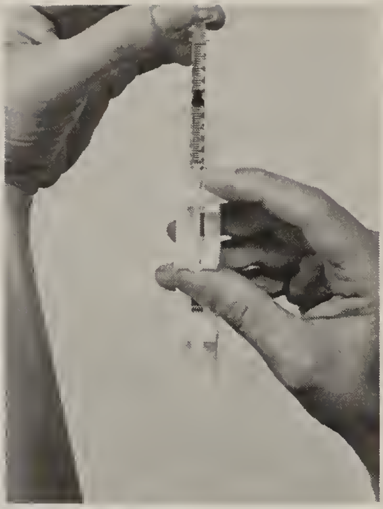
Disadvantages: Some consumers report long waits for order to be filled. Device has a 2-unit play in the notch where plunger base rests, which can cause a 2-unit dosage error if care is not taken to perform technique of measurement consistently.

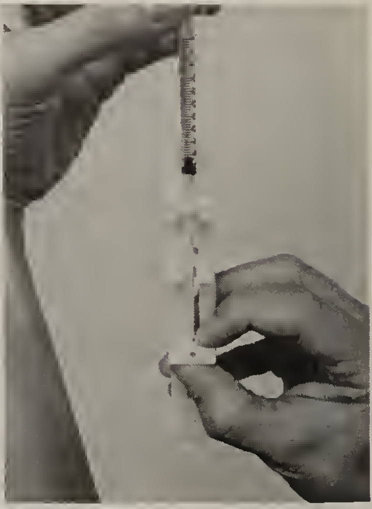
Solutions: Dosage error may be avoided by consistently pulling plunger out farther than necessary, inserting plunger base into notch, plunger shaft into hollowed edge, and pushing in until gauge prevents plunger from further movement. Plunger base will always be resting against back of the notch, with base of syringe barrel fixed against top edge of gauge. Distance between plunger base and barrel base will always be consistent; dose will be constant. (D.M.)

Meditec, Inc.
9485 East Orchard Drive
Englewood, CO 80111
(303) 771-4863

Price: large print label—$3.50
braille label— 4.00
raised numbers— 4.50
To order: obtain order for
from Meditec

Morris Watts Insulin Gauge





Measures 5 1/2″ x 3/4″ approximately. Made of durable plastic. Consists of a long, narrow foundation into which are molded two sturdy raised clips and on which are mounted two adjustable blocks. The first set of clips, prongs, hold the syringe barrel; an inch below, a second set, a raised horizontal channel, holds the fingergrips of the syringe. On the bottom two-thirds of the foundation, the two stops are attached by screws to a vertical slide which allows them to move forward or back. The screws tighten the stops in the desired position to regulate the distance to which the syringe plunger may be either pushed or pulled. The plunger can move only between these two blocks. They allow a mixed dose to be drawn up.

During use, the syringe barrel and fingergrips are fixed in their respective clips with needle extending over the top edge of guide. The first "adjusta-stop" is shaped like the letter "H". While the narrow space between the uprights allows the plunger shaft to rest on the crossbar, it also catches and holds the disk of the plunger base. It is set at a distance corresponding to the dose of the first insulin and prevents the plunger from being pulled back farther than the distance needed to draw up prescribed dose of second insulin.

To draw up a mixed dose, a disposable syringe still covered by its needle guard is placed in the guide by slipping the syringe plunger into the first stop at the space between uprights of "H" and holding disk of plunger base against first stop while pulling syringe barrel forward with other hand until syringe fingergrips come to rest properly in the riase horizontal channel; then the barrel's midsection snaps into top prongs. Finally, the plunger is withdrawn until the disk of its base rests against second stop. The needle guard is removed, and the needle is inserted into first insulin vial. Plunger is pushed all the way to first stop to inject air and pressurize vial; because its motion is arrested by first stop, syringe will still contain a column of air equal to first insulin dose. Ideally, the plunger is then withdrawn quickly and smoothly so that insulin from the vial rushes into syringe and through air already contained. The first insulin thus fills barrel from bottom of space upwards in an amount greater than its prescribed dosage. The manufacturer recommends flicking the syringe barrel with the fingers at this point in order to disperse any air bubbles which might cause dosage error. Then excess insulin and the column of air on top are expelled into vial of first insulin by pushing plunger in until first stop again arrests its movement. With plunger thus pushed all the way to first "adjusta-stop," correct dose of first insulin is measured.

To measure second insulin, syringe is removed from first vial, and needle is inserted into vial of second insulin. Plunger is pulled to second (bottom) "adjusta-stop" to withdraw prescribed dose of second insulin for mixed dose. The manufacturer recommends that either a physician or nurse set this device and demonstrate its proper use; practice should proceed under medical supervision.

Essential features: For either B-D Plastipak Lo-Dose Syringe or Monoject disposable syringe in either 1cc (full size) or 1/2cc (lo dose).

Advantages: Screws, washers, and plastic are of highest grade material so that the "adjusta-stops" are fixed tightly and reliably at desired settings. Lightweight and compact. Durable. Fingergrip channel is designed to hold B-D Lo-Dose Syringe securely. With use of magnifying glass, consumer with low vision can set the device independently. (B.C.)

Disadvantages: Cannot be adjusted at will without vision. No provision for using device to measure and inject pressurizing air into second insulin. Monoject 1/2cc syringe fits less snugly into fingergrip channel allowing the possibility of some play and dosage error. Ability to use various brands and models of disposable syringes has potential for dosage error: once the device is set for one brand and type of syringe, it is accurate *only* for that brand and type, even while others will fit device. Large air bubbles replacing insulin and causing dosage error *can* occur if plunger is not withdrawn quickly and smoothly. As explained above, the first insulin must rush past a column of air already standing in the syringe. If the plunger is withdrawn too slowly, insulin does not rush in with sufficient force to flow under the air and displace it; rather, air is trapped at bottom of dosage column so that air bubbles form. In our limited experience and evaluation, the manufacturer's recommendation to snap barrel repeatedly does not always disperse bubbles so that insulin dose is corrected.

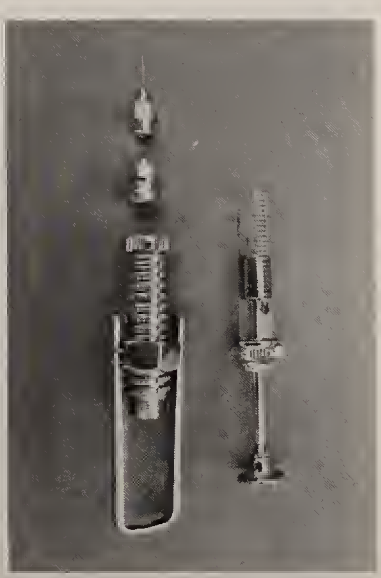
Solutions: To pressurize second insulin vial, an arbitrary amount of air may be injected with syringe before it is place in guide. To avoid interchanging brands and models of syringes and to avoid play noticeable with Monoject 1/2cc syringes, consistently use B-D Plastic Lo-Dose Syringes. To avoid air bubbles, practice proper technique under medical supervision until perfected or have syringe checked by sighted help.

Canadian National Institute for the Blind
350 East 36th Avenue
Vancouver, B.C.
Canada V5W 1C6

Homecraft Department
Canadian National Institute for the Blind
1929 Bayview Avenue
Toronto, Ontario M4G 3E8
Canada

Price: $3.25
(Canadian currency)

AFB Insulin Syringe



Measures 5 1/2″ in length with plunger fully extended; barrel is 1/2″ in diameter. Barrel consists of brass nickle-plated casing which encloses a 2 cc glass syringe barrel. Plunger is stainless steel. The principal fitting is a U-shaped brace or plunger stop. Also brass nickle-plated, the ends of the brace pivot on a nut which moves up or down the barrel of the casing by rotating along the screw-thread machined the entire length of the casing. When the brace is in line with the metal casing, it serves to catch the plunger base in the notched U of the brace, fixing the distance between plunger base and syringe base. This distance corresponds to a particular dosage of the interior glass syringe. This distance, and thus the dosage, is monitored and set by rotating the nut to which the brace is welded. Beginning with nut in position closest to needle end, each quarter rotation on screw-threaded casing produces an audible click; each click indicates an increase of 1/20 milliliter of liquid. The syringe may be used to measure any strength insulin—U-40, U-80, or U-100. The number of clicks to turn the nut must be determined mathematically for a particular insulin strength. For example, to determine number of clicks for a dose of 20 units of U-100 insulin, consider the following givens and reltionships: each click indicates 1/20 milliliter of liquid; each milliliter of U-100 insulin contains 100 units of insulin. Thus each click withdraws 5 units of insulin because 1/20 (number of milliliters per click) x 100 (number of total insulin units per milliliter of liquid in U-100 insulin) = 5 (units of U-100 insulin per click). Then 4 clicks would draw up the desired dose of 20 units (4 clicks x 5 units per click = 20 units of U-100 insulin). By turning nut so that 2 clicks are heard, the brace is in place to withdraw plunger for filling syringe with 10 units U-100 insulin; 3 clicks for 15 units; and so on.

With the U-shaped plunger stop so set for the correct dose, the plunger is first withdrawn fully. Then the U-shaped stop is pivoted up to the position which aligns with syringe barrel and plunger. Plunger is next pushed in until the disk of the plunger base is caught and halted by the notch in the bottom of the U-shaped stop: this procedure measures air to pressurize insulin vial. U-shaped plunger stop is pivoted down at a right angle with device barrel, to make way for the plunger to be pushed in. Thus air is injected into vial, vial with syringe still inserted is inverted, and plunger is then withdrawn to furthest position drawing up a quantity of insulin greater than required dose. To measure correct dose, U-shaped stop pivots once more to align with device barrel, and plunger is pushed in until disk of base is halted by preset plunger stop, as in measurement of pressurizing air. This maneuver expels excess insulin back into vial, and correct dose remains in syringe for injection. Entire unit is used.

Essential features: Requires addition of stainless steel needle or disposable microfine needles. Requires sterilization. Unit consists of seven separate parts: metal barrel casing; brace on nut; glass interior syringe barrel; needle connector; plunger shaft; plunger head (which can unscrew from plunger shaft); nut for base of metal barrel.

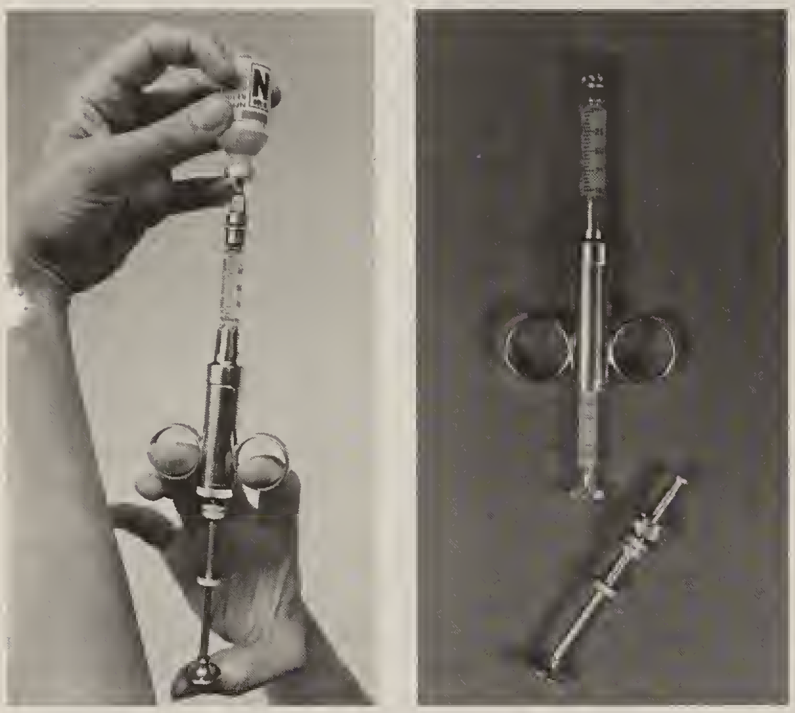
Advantages: High quality, durable materials. Precision-made. Independently adjustable. Can be used to change dose at will without sighted help. Could be used for multiple daily injections of regular (rapid-acting) insulin for tight control.

Disadvantages: High level of concentration and hearing and/or tactual sensitivity required to hear clicks or feel resistance which indicates dosage increments as stop is rotated on barrel. Because of number of separate parts, reassembly after sterilization can be difficult, especially with vision loss. U-100 insulin can be measured in 5-unit increments only. U-40 insulin can be measured in 2-unit increments (since each click = 1/20 milliliter, and 1/20 milliliter of U-40 = 2 units of insulin); however, U-40 insulin is being phased out. Math to determine number of clicks for desired dose can frustrate some persons. Difficulties can discourage reliance on device and thus independence. (J.W.O.)

American Foundation for the Blind
Consumer Products Department
15 West 16th Street
New York, NY 10011
Price: $26.00
Order No.: MES 260

Boers & Co. B.V.
Postbus 67
3100 AB Schiedam
Rotterdam
The Netherlands

B-D Cornwall Syringe



Body of the principal mechanism measures approximately 3″ in length and 1/2″ in diameter. In its pronged opening, this metal cylinder holds a Becton-Dickinson glass 1 cc U-100 syringe, its barrel extending fully from the cylinder with the barrel base gripped firmly within the prongs. The cylinder itself contains the glass plunger which has been inserted through a metal spring. A metal plunger enters the base of the metal cylinder through a threaded metal regulating sleeve which screws into the base of the metal cylinder. Inside the metal cylinder, this threaded sleeve acts as a plunger stop; it fixes the distance to which the glass syringe plunger can be withdrawn and sets the prescribed dose of insulin. The more the metal sleeve is screwed into the base of the metal cylinder, the farther the glass plunger is set into the glass syringe barrel, and the smaller is the dose thus set. The two lock nuts at the top of the metal sleeve are to hold the setting tight. The metal plunger which slides through the sleeve also makes contact with the disk of the glass plunger inside the metal cylinder. With device held vertically and needle inserted into inverted vial, the function of the metal plunger is to push the glass plunger all the way into the glass syringe barrel, an action which expels air into the insulin vial and compresses spring around glass plunger. The metal plunger is then released, and this action allows the spring compressed around glass plunger to recoil and retract glass plunger but only to position of regulating sleeve, which acts as plunger stop. Thus the desired dose of insulin is withdrawn.

The two circular grips welded to the exterior of the cylinder enable the fingers to grasp the device firmly in order for the thumb to squeeze the plunger.

Essential features: Requires the addition of reusable stainless steel or disposable microfine hypodermic needles. Requires sterilization. When disassembled, consists of five separate components. Measures single dose only. To be set by health professional; can be ordered by doctor or nurse only.

Advantages: Can be set accurately (with the use of sight). Metal components are durable; glass syringe is replaceable. Withdraws proper dose smoothly and quickly.

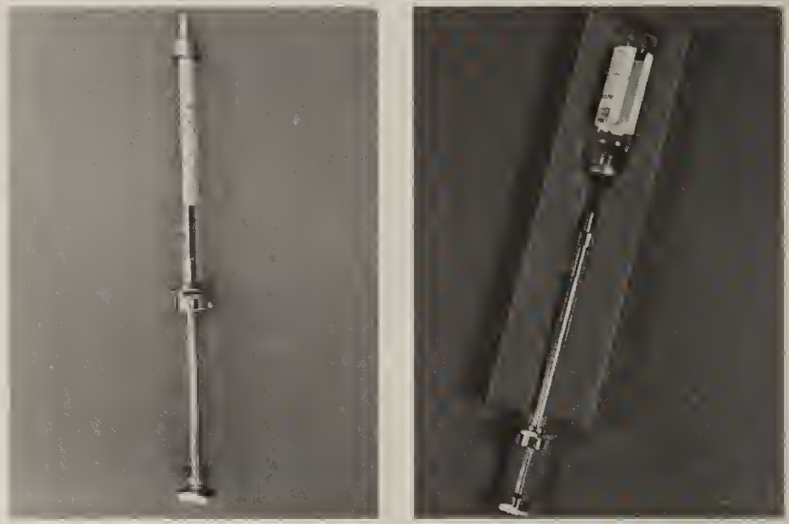
Disadvantages: Must be set by sighted help. Without careful and consistent technique, lock nuts *can* unscrew and change setting (especially increase) during use or during disassembly sterilization and subsequent reassembly. (J.O.W.) (R.M.C.) Must be reset after each sterilization.

American Foundation for the Blind
Consumer Products Department
15 West 16th Street
New York, NY 10011
Inquire for price and
availability

Independent Living Aids, Inc.
11 Commercial Court
Plainview, NY 11803
Price: $17.50
Order No.: 384890

Replacement Syringe
Price: $5.95
Order No.: 658225

Click-Count Syringe



Syringe measures approximately 5 inches in length. Consists of metal tip for connecting needles, glass barrel marked for one-unit increments of U-100 scale, metal base of syringe barrel, through which passes the shaft of the syringe plunger. The metal plunger shaft is notched at 2-unit intervals on one flat side, and the disk of its base is flattended on one side. Inside the metal base of the syringe barrel, the plunger shaft is gripped by two parallel pins. When the disk of the plunger base is turned so that its flat side aligns with a tactually prominent screw on base of syringe barrel, then the notched side of the plunger shaft is pulled under one of the parallel pins. Each notch clicks against the pin as plunger is withdrawn. Resistance is felt and a click is heard for each 2-unit increase. Thus air would be measured to pressurize vial. To inject air into vial, the plunger shaft would be turned one quarter revolution clockwise to free notched edge from parallel pins; this motion turns smooth sides of the shaft against the parallel pins—the "glide" position. Now the plunger may be pushed in smoothly to inject vial with measured amount of air. To withdraw prescribed dose of insulin, the disk of plunger base is turned clockwise until the flat edge again aligns with screw on syringe base. Now shaft is in position to indicate by clicks 2-unit increments as it is withdrawn. To withdraw plunger for insulin measurement, it is gripped between thumb and index finger close to syringe barrel. The grip is tightened and loosened with a squeezing action against base of syringe barrel. With the grip thus maintained close to barrel, the syringe shaft feeds through the fingers in movements of one notch at a time, always signaled by a click indicating 2 units of insulin. The dose can be checked by counting the exposed notch on the shaft with a fingernail. The number multiplied by two equals the number of units of insulin withdrawn into syringe. To inject, plunger shaft is turned to glide position and plunger is pushed in.

insulin withdrawn into syringe. To inject, plunger shaft is turned to glide position and plunger is pushed in.

Essential features: Requires sterilization. For use with U-100 insulin only. Can measure mixed doses. Manufacturer provides instructions.

Advantages: Simple in concept, beautifully machined, high grade materials. Accurate with careful, consistent, painstaking technique. Any dose may be measured at will independently.

Disadvantages: Requires highest degree of concentration, manual dexterity, hearing or tactual sensitivity, and patience. Slightest extra pressure during measurement can cause plunger to slide off setting to which it has been pulled.

Solutions: Practice under medical supervision is strongly recommended.

Hypoguard Limited
Dock Lane, Melton
Woodbridge, Suffolk
England IP12 1PE Price: L 6.00

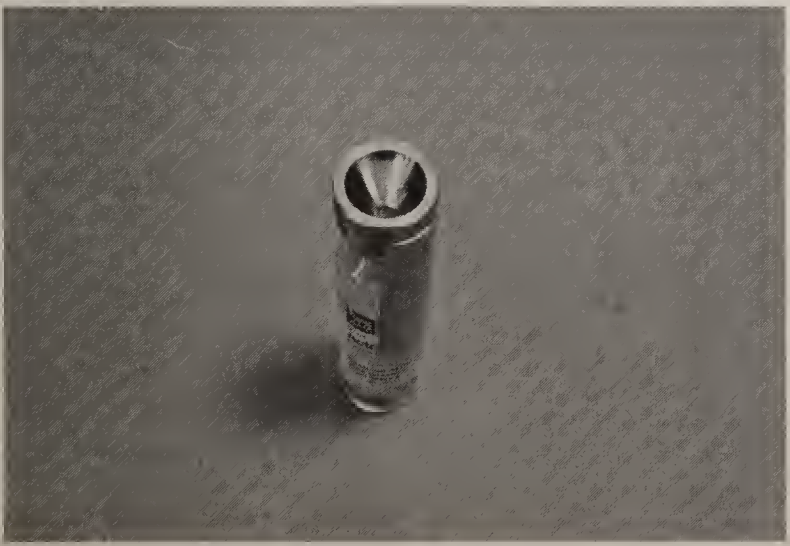
Needle Guides

AFB Needle Guide

Aluminum nut machined to fit vial cap of Eli Lilly insulin, AFB Needle Guide can be used with other brands but may not fit as snugly or may resist application and removal. Funnel-shaped interior of top guides needle to rubber stopper. Hexagonal base provides flat edges for gripping this relatively small object, but tactual sensitivity is still required. (A.R.V.) Sterilize guide to prevent needle contamination. Made of aluminum which may scratch and burr to catch or blunt needle.

American Foundation for the Blind
15 West 16th Street Price: $2.50
New York, NY 10011 Order No.: MES 168

Centrepoint Needle Guide

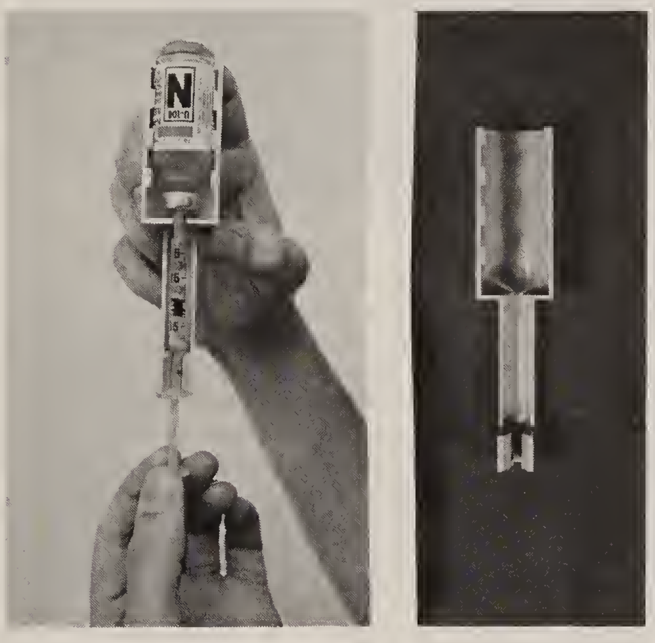


Aluminum sheath, 1 3/4″, provides cradle for narrow vials of Nova range of insulins, which are manufactured in Denmark, distributed in Western Europe and United Kingdom, and have been recently marketed in the United States. Friction holds the guide in place, topped by high quality medical grade stainless steel funnel which guides needle to vial stopper. Sterilization by boiling is recommended preparation before each use.

Manufacturer reports production of another model to fit the Burroughs Wellcome range of insulin available in the United Kingdom. In addition, manufacturer intends to produce a Centrepoint to fit Eli Lilly brand of insulin in the near future.

R.N. Beard
15 Kings Ride
Blackfield
Southampton SO4 1ZN
England Price: L 7.00

Holdease Needle Guide



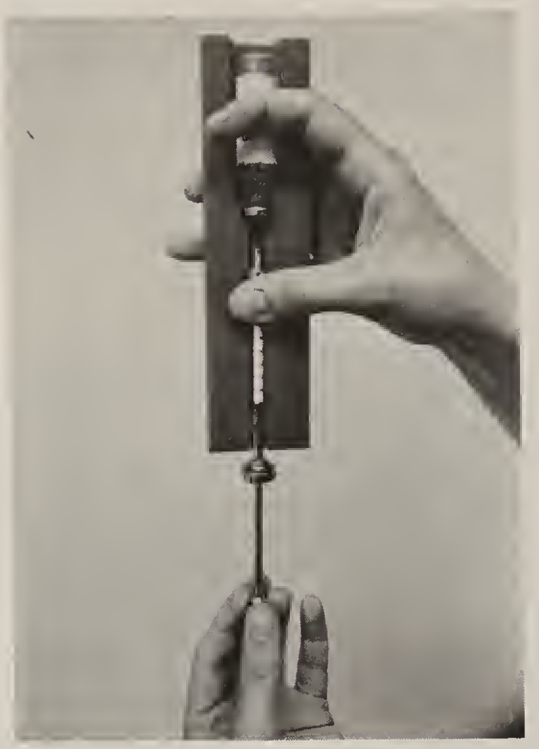
Plastic cradle to hold vial aligned with trough to hold syringe. Barrel of syringe is held by clip molded onto trough while needle protrudes through slot in center divider to penetrate vial stopper on target. To prepare for use, cleanse divider with alcohol swab. Clean in warm suds; do not immerse in water hotter than 150°F (well below boiling). Ideally, no part of guide requires sterilization since no part interrupts path of needle to vial stopper. Manufacturer provides clear directions for use. Designed for standard American insulin vials but can be used with tall, narrow bottles common in Europe. Keeps vial and needle steady for easy handling as a single unit, even for those having coordination problems. (D.M.) Useful with staple templet or Insulgage. (R.B.C.)

American Foundation for the Blind
Consumer Products Department
15 West 16th Street Price: $11.75
New York, NY 10011 Order No.: MDC 8120

Independent Living Aids, Inc.
11 Commercial Court Price: $9.95
Plainview, NY 11803 Order No.: 37022

Meditec, Inc.
9485 East Orchard Drive
Englewood, CO 80111 Price: $9.75

Location Tray



Heavy, durable plastic foundation is impressed with shape of insulin bottle aligned with trough for glass insulin syringe. The bottle well will accept either the elongated European vial or the stocky American type; the syringe trough will accept *only* long, thin glass syringes such as type used in Click-Count Syringe. The Click-Count Syringe fits perfectly. With bottle and syringe aligned in tray, needle is directed to center of vial stopper. When in vertical position for insulin withdrawal, tray does not hold syringe and vial tightly. Plastic is smooth and rigid: it cannot hold vial and syringe by friction, and it has no clipping features. Manufacturer does not specify sterilization procedure.

Hypoguard Ltd. Dock Lane, Melton Woodbridge, Suffolk IP12 IPE England Tel. 03943 7333	Price available on request from manufacturer.

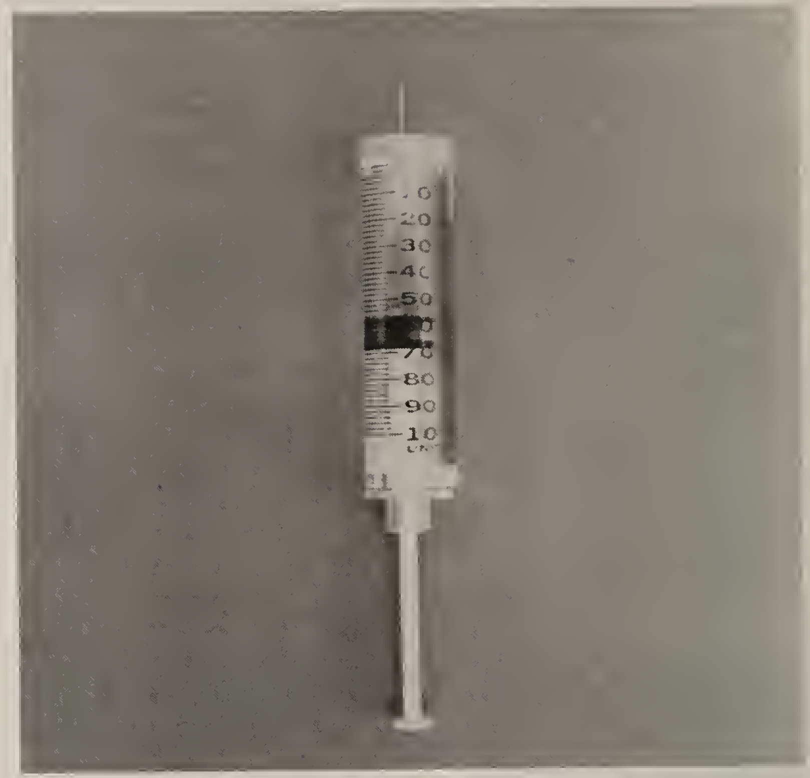
Syringe Magnifiers

When contributors to this issue of AAR were surveyed regarding the available syringe magnifiers, it was revealed that most insulin syringe magnifiers have been found to be of limited use especially to the severely impaired population. Joyce Schulz offered the following information in response to a request for an evaluation of syringe magnifiers:

> For people with sufficient vision to read syringe calibrations visually, Monoject "Half CC" or B-D Lo-Dose disposable syringes are available. These syringes measure 50 units of insulin or less and are easier to read as each unit on the syringe is marked in large numbers.
>
> For those who desire more magnification, Char-Mag Company of Milwaukee manufactures a syringe magnifier that fits the entire length of the syringe and does not distort the numbers which are two advantages this device has over other syringe magnifiers. However, if a person has sufficient visual loss, possibly coupled with fluctuating vision, so that he or she cannot read the syringe, it is recommended that for safe and accurate measurement a non-sighted technique be used. Very often the magnification is sufficient to make the numbers readable but not the line calibrations between numbers.

For independent evaluation and inquiry, the following resources for insulin syringe magnifiers exist.

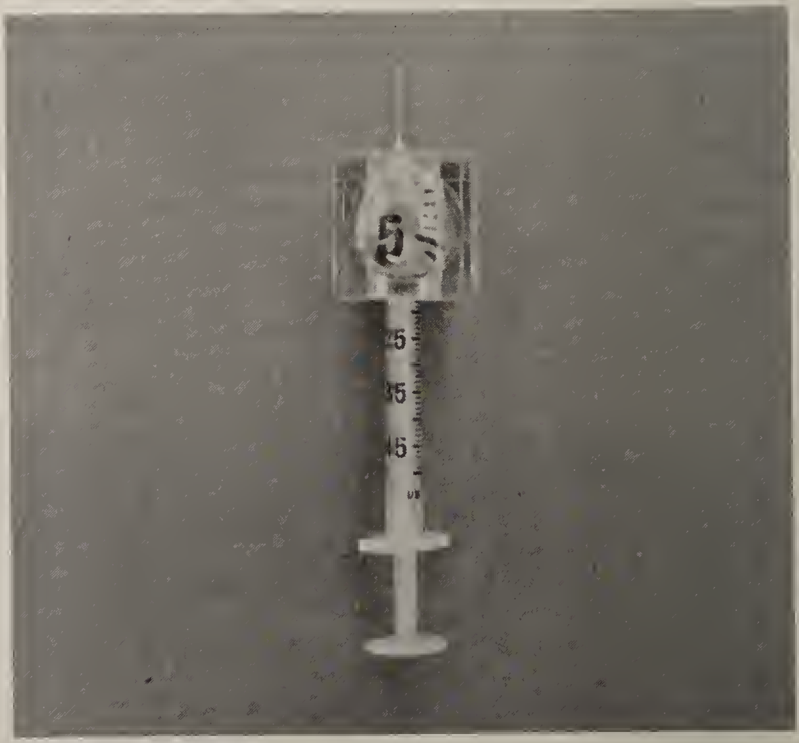
Char-Mag Syringe Magnifier



Device is a 2½″ bar magnifier that clips onto a B-D Long Plastipak U-100 Syringe or the Monoject 1 cc disposable plastic syringe. It extends the entire length of the syringe.

American Foundation for the Blind Consumer Products Department 15 West 16th Street New York, New York 10011	Price: $4.50 Order No. LMC 7100
Independent Living Aids 11 Commercial Court Plainview, New York 11803	Price: $4.50 Order No. 074300

Monoject Syringe Magnifier



Device is a 3/4″ circular magnifier centered in a rectangular plastic housing that clips onto syringe in area of dosage to be measured. Will fit any plastic disposable insulin syringe, andy brand, any type.

Monoject Division of Sherwood Medical St. Louis, MO	Price: $1.98 (suggested retail) Available through local pharmacies.

GLUCOSE LEVEL MONITORING

According to clinical definition, diabetes control means maintaining the concentration of glucose in the blood at levels within the range considered normal. Amount, kind, and timeing of food intake, of exercise, and of insulin injected can interplay to establish and maintain the blood glucose level within normal ranges. (Refer to "Diabetes: Some Physiological Considerations for the Blind Person.") Because the distinct but interrelated influences of diet, exercise, and insulin therapy converge to increase or decrease the amount of glucose in the blood, the blood glucose level can be seen to reflect the effectiveness of efforts to manage any one, or all, of the points of the network: diet, exercise, insulin therapy. Monitoring blood glucose levels is thus a crucial aspect of diabetes control. When levels rise above or fall below normal range, they can signal need for adjusting diet, exercise, or insulin dose.

Equipment for Urine Glucose Analysis

Either blood or urine may be tested to detect the concentration of glucose in the blood. Until recently, the method commonly used was the procedure of testing a urine specimen for glucose. Glucose in the urine often, but not always, results from higher than normal concentrations of glucose in the blood, since it is the function of the kidneys to cleanse the blood of any impurities (in this case, exessive sugar) and spill the impurities into the urine to be voided from the body. Thus, the percentage of urine sugar can reflect the percentage of blood sugar. (Refer to "Home Blood Glucose Monitoring for the Visually Impaired Diabetic" for an explanation of the limitations on interpreting blood glucose levels from urine glucose levels.)

Commercial Reagent Tests

The basic equipment for urine testing is (1) a second specimen of urine voided 30 minutes after a first void, during the hour before a mealtime, and (2) one of the several chemical tests available. The chemical tests consist of reagent material which reacts chemically with any sugar present in the urine and which indicates that reaction by changing to one of several specific colors; the specific color correlates with a specific percentage of sugar in the urine. (For a detailed evaluation of the four major commercial reagent products—Clinitest, Tes-Tape, Diastix, and Clinistix—consult the *Joslin Diabetes Teaching Guide.*) The test is accomplished by dipping the strip of reagent material into the urine specimen and matching the strip's resultant color change to a color chart labeled in respect to percentages of sugar indicated. With the Clinitest product, tablets are dropped into a carefully prepared urine specimen, and the entire specimen is observed for a change in color.

Obviously, vision loss can either interfere with comparing the color change to the color chart or can make it impossible. Even with remaining light and color perception, matching the colors can be a problem, since for all the products the closeness in hue of the individual colors can render them difficult to distinguish. For example, the Tes-Tape, approximately 1/4 inch wide, changes from yellow, to light green, to darker green/blue, to darkest green/blue. Though it might be possible to discriminate the extremes—yellow to indicate sugar-free, as distinguished from darkest green/darkest blue to indicate 2% or more—it can be highly problematic to identify the middle ranges. Likewise, Diastix colors have been perceived as too close in hue for certain discrimination—blue, light green, dark green, olive green, light brown, dark brown—to indicate certain percentages of sugar. A larger surface of reagent material has been found helpful to some people; the color change of a longer than normal strip of Tes-Tape, even though still narrow, can sometimes be distinguished with remaining vision. The pre-cut reagent strips called Diastix come in a larger, 1/2″ wide size, under the trade name Mega-Diastix. For some people the color changes of this product are distinguishable.

Audible Urine Analyzers

Electronic devices which can sense the specific color changes on reagent material and which can audibly signal the specific color provide an alternative to sight in testing urine for glucose percentage.

The Uricator, manufactured by Science for the Blind, electronically detects and compares the color changes on a strip of Lilly Tes-Tape; it audibly indicates the color and thus the glucose percentage. The cassette tape which accompanies the *Uricator* provides the technical description of the device along with step-by-step instructions for operating it, as follows.

Housed in a black plastic box, which measures 5″ x 4″ x 1 1/2″, the *Uricator* operates on a nine volt battery. The box rests on four small rubber feet. On the top surface of the box toward the front is a row of four push buttons; behind the push buttons on the right is a small toggle switch, which turns the unit on. To the left of the toggle switch is the test block consisting of two small, parallel bars about 1/2″ apart. The sensing window lies in the space between the two bars. A hinged cover closes down between the two bars and over the sensing window.

The device operates as follows. A urine specimen is first prepared in the usual way. A one or two inch strip of Tes-Tape is pulled from the roll and dipped in the urine; after a wait of one minute, the wet tape is placed in the slot and over the sensing window, between the two raised bars, and the hinged lid is closed and held down over the tape to keep it flat and to keep out extraneous light. Under the tape, the sensing window consists of a square of transparent plastic covering a hole through which a light from inside the box shines onto the under side of the tape, then reflects back through the hole to the sensor. The sensor's response is proportional to the color of the tape. With the hinged cover held down lightly on the tape, the four buttons are pushed in succession, beginning with the leftmost button, until one of the buzzers sounds, indicating the sensor's response. If the first button sounds (yellow), it indicates no sugar; if the second buzzes (light green), 1/10%; if the third (darker green/blue), it signals 1/4%; and if the fourth (darkest blue/green), 2% or more.

One of the critical aspects of this test is the one-minute lapse of time between dipping the Tes-Tape into the urine and testing for the color change; this exact amount of time is required for the reagent material to respond to any percentage of glucose and change colors. So that the person using the *Uricator* does not have to time the minute somehow, the timer is built into the unit. The Tes-Tape is dipped into the urine *just before* the toggle switch activating the machine is switched on. Switching the toggle switch to "on" not only activates the device but also starts the one-minute timer built into the machine; a buzz sounding from within the box indicates that the critical one minute has elapsed; the Tes-Tape, having made any color change, is ready for detection. The machine will then be active, capable of sensing and indicating the specific color change, *only* for the next *30 seconds*. Within that 30 seconds it is crucial to place the wet tape into the slot of the testing block, pull down the hinged lid, hold it gently down over the tape, and push the testing buttons in succession, until one sounds. If the test has not been completed within the 30 seconds following the "activated" buzz, then the machine must be turned off, and the test performed all over again through each step of the sequence using a new strip of Tes-Tape. The original strip will not give accurate results for a second test.

The time limit of 30 seconds is said to be adequate for most *practiced* users. It is emphasized that for initial tests with the device, the user should practice with sighted help so that double-checks may be made on the tape's color change and the device's audible signal. For persons who have access to sighted help and to a *blood* glucose monitoring device, the results of the Uricator analysis may also be compared with those of direct blood glucose testing. (For one *Uricator* user in the Boston, Massachusetts, area, the *Uricator's* results compared favorably with the results of her blood glucose monitor, whose digital display of glucose percentage was read by family members.)

So far, one limitation of the *Uricator* has been noted: its accuracy depends on the accuracy of the reagent material used, Tes-Tape. In many circles there is some controversy regarding the accuracy of Tes-Tape; it is felt that the color changes in the upper ranges are too ambiguous to make the tape reliable for glucose percentages above 1/2%.

But some *Uricator* users have reported much satisfaction with the device. One person interviewed compared the results of the Uricator with other methods of urinalysis undertaken with sighted help: she observed that the *Uricator* results were, for her, just as accurate. Certain overall contributions of the device have been reported also. To a homemaker, who manages diabetic control independently during daylight hours, the *Uricator* gives the capability of objectively confirming any high glucose levels; with this information, she can decide either to plan different foods or eat less for a few meals, or to take time out for walking, stationary cycling, or swimming—activities in her regular exercise program. She states enthusiastically that using the *Uricator* makes her feel more in tune with herself and more in control of her life. The catalogue of Science for the Blind tells of the experience of another *Uricator* owner: "During a bout of flu he monitored his sugar level closely, eating or not at bedtime, depending on the level, and not disturbing his wife to help with a test in the middle of the night."

Uricator

Science for the Blind Products
Box 385
Wayne, Pennsylvania 19087
(215) 687-3731

(Calls for orders or information are taken 10 a.m. to 10 p.m. each day.)

Price: $125.00
Order No.: T-16

The Hypo-Test Audio Urine Meter is produced by Hypoguard Ltd. in England and is not yet available in the United States. However, upon approval by the Food and Drug Administration, the company plans to explore with the American Foundation for the Blind the possibility of marketing the *Hypo-Test* in the U.S.A. Like the *Uricator*, the *Hypo-Test* is a compact plastic box; the top surface contains the test block for holding the wet Diastix as well as the knob turned to activate the indicator-buzzer. The company provides the following current product specifications:

> This instrument measures glucose levels in urine in conjunction with an Ames Diastix. Range: 0%-2%. Accuracy: Instrument only + 5%. Power: Batteries rechargeable—100 operations between charges. Size: 16cm x 10cm x 6cm. Temperature: Designed for operation in temperatures of 0 C—50 C. Features: Timer gives audible signal for drying Diastix; Results are communicated by buzzer code for the following values: 0%, 1/10%, 1/4%, 1/2%, 1%, 2%; an abort signal sounds if user delays in completing the test sufficiently to make test inaccurate; a special battery test function allows battery level to be checked prior to urine test. The Diastix holder can be removed from the device for washing.

Hypo-Test

Hypoguard Ltd.
Dock Lane, Melton
Woodbridge, Suffolk
England 1P12 1PE
Tel: Woodbridge (03943) 7333/4

A homemade urine-glucose analyzer with an audible code can be built from components purchased from an electrical supply store. One such device is described in the March 1977 issue of *Diabetes*, volume 26, pages 192-195; it is called the *Audio-Urine-Glucose Analyzer*. The authors of the article, who developed the machine, describe its construction and their testing of it. Provided as well are essentials for constructing and using the device: the circuit diagram, instructions for calibrating the device, instructions for operation. The authors estimate a cost of $150.00 (1977 prices) for materials and about 24 hours of work.

Yeast Method

An alternative method of urine-glucose analysis, which might be called tactual, is the yeast method. Though it can be messy, cumbersome, and time-consuming, the procedure is still used by some people. It is based on the fact that glucose reacts with yeast to produce a gas, carbon dioxide. A test tube containing the urine specimen (approximately 12 cc) receives 1/4 teaspoon of yeast; a finger cot is then placed over the test tube opening. After about 10 minutes, if glucose is present in the urine, the yeast reacts with it to produce carbon dioxide; the gas expands to inflate the finger cot covering the test tube. The relative tautness of the inflated finger cot can be felt to determine the approximate amount of glucose present—none, a moderate amount, a great deal. The information gained is only a rough indication. Yet even with its obvious limitations, the method may be appropriate for some people seeking independence in urine-glucose analysis with vision loss.

For all of the methods of urine-glucose analysis described, the advantages are to be weighed against limitations, and, of course, any selection of method must take into consideration the particular needs and capabilities of the person using the method—amount and kind vision loss, hand motor skills (though no extraordinary ones are needed), motivation. In addition, it should be remembered that there are limitations to the value of urine-glucose testing explained in the following article, "Home Blood Glucose Monitoring for the Visually Impaired Diabetic."

Home Blood Glucose Monitoring for the Visually Impaired Diabetic

by

Judith W. Oehler, R.N., Ed.D.

Home blood glucose monitoring is perhaps the most exciting innovation in the treatment of diabetes since the discovery of insulin. With a disease which must be patient-managed, it is inspiring that diabetologists have realized the importance of providing to the diabetic the opportunity to monitor blood glucose, a responsibility previously restricted to the physician.

As indicated by the title of Dr. Charles Peterson's book, *Take Charge of Your Diabetes*, home blood glucose monitoring enables the individual to take charge rather than to be controlled by the diabetes. In addition, "The assumption by patients of the responsibility for management of their own disease tends to break the pattern of nihilism and frustration often found in both patient and physician."[1] Finally, home blood glucose monitoring teaches even the veteran with diabetes new information regarding the effect of insulin, food and exercise upon the blood sugar.

Urine testing, the traditional method for monitoring diabetes self-care, provides only an indication of how high or low the blood sugar actually is. Normally, one's blood sugar should be between 70 and 140 milligrams per deciliter (mg/dl) of blood. Ninety mg/dl is the normal premeal blood sugar. Glucose or sugar normally spills into the urine (renal threshold) at 180 mg/dl. Consequently, a negative (blue) urine test with Clinitest indicates that the blood sugar is 180 mg/dl or lower, but not how low, and can reflect a blood sugar ranging anywhere from 0 to 180 mg/dl. A trace reading with Clinitest indicates that the blood sugar is at least as high as 180 mg/dl. A four plus (yellow or orange) Clinitest reading indicates that the blood sugar is high, but not how high. Blood sugar in this case can be 350 mg/dl or higher. Another problem with urine tests is that the renal threshold of long-term diabetics may be altered so that glucose may spill into the urine at a point above 180 mg/dl. In such cases urine tests appear lower than they actually are. In general, while urine testing provides one with a "hunch" as to what the blood sugar is, home blood glucose monitoring provides an exact reading.

The individual experiencing vision loss from advanced diabetic retinopathy may be frustrated with the inadequacies of urine testing, and yet may also be frustrated by the difficulty or inability to perform home blood glucose monitoring because of the visual impairment. Rather than approaching this situation helplessly, it is the opinion of this author that the individual must say to himself or herself, "If home blood glucose monitoring is important to me, I will find a way to have the test performed in spite of my visual impairment." It is also the opinion of this author that the easiest way to initiate a program of home blood glucose monitoring, is to begin by using the Chemstrip bG system manufactured by Biodynamics. Chemstrips do not require the use of a reflectance meter, or wash bottle and sink, they are extremely portable, and they are easy to read because the strip has two color reagent zones. Blood is placed on the reagent zone and wiped off with moderate pressure using cotton or tissue sixty seconds later. After waiting four minutes, the colors of the reagent zones are compared with color blocks ranging from 20 to 800 mg/dl which are on the Chemstrip bottle. Because of its simplicity, the low vision diabetic may be able to perform the Chemstrip test, but should there be difficulty matching the strip to the color blocks, it can be saved and read by another person later, as the strip remains stable. If the diabetic cannot perform the Chemstrip test, it is relatively easy for family, friends or readers to learn the procedure. The portability of the test permits it to be conducted in the office of a colleague, the home of a friend, or in any other location.

Chemstrips can usually be ordered through a local pharmacy. Each bottle contains 25 strips. The expense of the strips and the amount of blood needed to cover the two reagent zones on a strip can be reduced by cutting Chemstrips in half lengthwise. When cutting strips, it is important not to touch the reagent area, and when cutting is finished, strips should be placed immediately back in the bottle for storage.

Reflectance meters or home blood glucose monitoring machines are also available. The main advantage of these machines is that they read the strip directly so that visual inspection of color zones is not necessary. However, the main drawback of these machines is that they are expensive as well as somewhat more complicated to use. Both Ames Company and Biodynamics Company manufacture reflectance meters in the United States. The term reflectance meter refers to the amount of light reflected or absorbed by the reagent area which is dependent on the amount of glucose in the blood. With the STATTEK from Biodynamics, blood is placed on a STATTEK strip and wiped off after sixty seconds. After an additional sixty seconds, the strip is placed in the STATTEK machine which reads the amount of sugar on the strip in a manner similar to a scale. The meter provides readings from 50 to 350 mg/dl.

In 1970, Ames Company produced the EYETONE meter. This was the first reflectance meter available to measure blood glucose using a reagent strip. In the early 1980's, Ames developed the DEXTROMETER, a lighter machine than the EYETONE, which provided a digital read out of the blood sugar, and had the ability to be operated by a battery pack. The DEXTROMETER sells for $275. Soon after the DEXTROMETER was on the market, Ames developed the GLUCOMETER specifically for use by patients.

The GLUCOMETER which lists for $250 is lighter than the DEXTROMETER, is battery operated, has a digital read out, and in addition a built in timer which indicates when the strip should be washed off. With all Ames machines, the Dextrostix must be used, and the strips must be washed off with a stream of water at a specific time.

Studies have shown that the results of blood tests performed by diabetics in the home are as reliable as those performed in the laboratory. In addition, Chemstrips have been found to be as effective as tests performed by the reflectance meters.

Most people find the easiest method for obtaining a drop of blood from the finger is to use the Autolet manufactured by Ames, which takes the Monolet lancet manufactured by Monoject. The Autolet is a device into which a lancet is placed so that when a button on the device is pressed, the finger is automatically lanced or pricked. To obtain a drop of blood, the finger is swabbed with alcohol and wiped dry with a tissue or allowed to dry. (Alcohol distorts the test.) Before lancing the finger, if it is cold it may be warmed in water or massaged to get the blood flowing through it. Tissue juices squeezed out with the blood will not distort the results. The sides of the finger between the tip and first joint should be used rather than the pad of the finger where nerves are concentrated. Once the finger is pricked, a drop of blood should be "milked" out by dropping the finger below the heart, and slowly massaging it until a drop of blood forms. When a drop of blood has formed, the strip is brought to it, and the drop of blood is transferred from the finger to the strip. Smearing should be avoided, and the entire reagent area should be covered.

None of the home blood glucose monitoring systems have been adapted for use by the visually impaired diabetic. For the individual severely visually impaired from advanced diabetic retinopathy, the most difficult step would be transferring the drop of blood from the finger to the strip. However, if it were important to the individual, even this step could be mastered. Because it would be difficult to master this step, companies which manufacture reflectance meters have not invested money in adapting machines for the visually impaired. However, this author believes that the more phases which the visually impaired diabetic can control during the blood test, the easier it will be for him or her to become involved in home blood glucose monitoring. Therefore, it would be of benefit to the blind diabetic if the reflectance meters had auditory output. The more steps the visually impaired diabetic can control, the easier it is for him or her to instruct a sighted individual to assist with the remaining steps in the test.

Since use of Chemstrips bG is relatively easy to learn, the visually impaired diabetic may want to begin home blood glucose monitoring using this system. If the blind diabetic familiarizes himself or herself with this system, he or she may supervise a sighted person performing the test. Public Health and Visiting Nurses as well as representatives of Ames and Biodynamics can be helpful in instructing visually impaired diabetics and sighted blood testers in proper techniques. State and Chapter affiliates of the American Diabetes Association can be helpful in supplying information on local representatives of these companies, and on medical companies supplying test strips, Autolets, lancets and related equipment.

In general, persons who conduct home blood glucose monitoring have the advantage of knowing precisely what their blood sugar is, and of learning how specific amounts of food, insulin, and exercise affect their blood sugar. Another advantage is improved well-being and lessened depression. It is possible that maintaining normal blood sugar (euglycemia) can prevent or delay the onset or progression of eye, kidney and nerve complications. Many diabetics who embark on programs of home blood glucose monitoring, find that the condition of neuropathy improves. Episodes of hypoglycemia have been reported to decrease, and in one study, symptoms of hypoglycemia previously identified were actually found to be related to normal or high blood sugar. Another advantage of blood testing is that the blood pressure and pulse often decrease resulting in less strain on the heart. Finally, an important advantage is that diabetics who test their blood sugar involve themselves as partners in controlling their chronic disease, with their physicians acting as consultants.

The main disadvantage of blood glucose monitoring is the expense of the strips and reflectance meters, and the commitment of time. Time involved in blood testing decreases with familiarity. Initially, the need to lance the finger may seem like a drawback, but just as one becomes accustomed to insulin injections, one becomes accustomed to finger pricks.

Record keeping is extremely important so that one may act on the results of the blood test. Results may be documented by use of tape recorder, or notebook when sighted persons assist with the test. The GLUCOMETER has a built in mechanism for recording test results. Initially, seven blood tests should be performed daily, before each meal, one hour after each meal, and before bed. For approximately two weeks the date, time of test, amount of insulin taken, exercise schedule, hypoglycemic episodes and other relevant information should be recorded. Records should be discussed with the physicians who will advise an appropriate alterations in the regime. Once euglycemia is attained, two to four blood tests daily are optimum.

Perhaps the most helpful book which has been published on the subject of home blood glucose monitoring is *Take Charge of Your Diabetes* by Charles M. Peterson, M.D. The book has been recorded by Recording for the Blind (215 East 58th Street, New York, New York 10022). An inkprint copy may be purchased for $3.95 form P.O. Box 9754, St. Paul, Minnesota 55197. It would be advisable to read this book before embarking on a home blood glucose monitoring program. In addition the July-August 1980 issue of *Diabetes Forecast* has an excellent article which discusses this subject.

It is extremely important that the visual impairment not interfere with testing urine or blood for glucose. The visual impairment may make it more difficult to initiate a program, but once a program is developed, the individual will find it becomes routine.

REFERENCES

1. Peterson, C.M., Forhan, S.E. and Jones, R.L. "Self-Management: An Approach to Patients With Insulin-Dependent Diabetes Mellitus." *Diabetes Care*, Vol. 3, No. 1, Jan.-Feb., 1980.
2. Birch, K., Hilldebrandt, P., Marshall, M.O. and Sestoft, L. "Self-Monitoring of Blood Glucose without a Meter." *Diabetes Care*, Vol. 4, No. 3, May-June, 1981.
3. Jovanovic, L. and Peterson, C.M. "Is Home Blood Glucose Monitoring For YOU?" *Diabetes Forecast*, Vol. 33, No. 4, July-Aug., 1980.

DIET AND EXERCISE MANAGEMENT

Diet

The effects of food and exercise on blood glucose levels have been and continue to be subjects of diabetes research. In respect to food, it is traditional clinical practice to prescribe a diet balanced in protein, fat, and carbohydrate and planned for calories as one component in glycemic control.

For many diabetics, a correlation between eating concentrated sweets and experiencing steep rises in blood glucose levels has been observed; thus, candy, pastry, and other foods saturated with simple sugar are eliminated from the orthodox diabetic diet. In addition, calories are controlled to fit exactly the person's energy requirements: calories are kept to the minimum to maintain ideal weight, since it has been observed that excess body fat can interfere with the cells' use of insulin; yet calories are also held at levels sufficient to balance the insulin dose, to prevent blood glucose levels from falling below normal.

In order to plan meals and prepare foods in accordance with this diet, information on food content is necessary along with recipes calculated for calories and for carbohydrate, protein, and fat in the prescribed balance. Exchange lists provide information on food content by dividing specific foods among basic categories such as milk, vegetable, fruit, bread, and meat. A measure of a specific food within a category will equal 1 Exchange—for example, 3 tablespoons of wheat germ equals 1 Bread Exchange. Exchange lists are used in conjunction with the diabetic diet, also called the diabetic meal plan, which details numbers and kinds of exchanges permitted each meal daily. Basic information on food composition is available in books on nutrition and in bulletins published by the U.S. Department of Agriculture. Exchange lists and meal plans are available from the American Diabetes Association, headquartered at 2 Park Avenue, New York, N.Y. 10016, with local affiliates across the country; diabetic clinics associated with large hospitals frequently prepare and provide their own exchange lists and meal plans tailored to the individual diabetic. Diabetic cookbooks provide recipes for dishes to fit the diabetic meal plan, and they are available, along with exchange lists and books on nutrition, in braille, on cassettes or disks, or in large print editions. A partial listing follows, and includes other cookbooks which are adaptable to the diabetic diet and available in nonvisual media or large print.

Resources

Breads: Guild Tested Recipes
Marie Porter, Editor
Chicago: The Guild for the Blind
50 recipes for wholesome yeast breads. (But recipes for quick breads contain much simple sugar.)

The Guild for the Blind	Braille
180 North Michigan	Cassette
Chicago, IL 60601	Large Print
(312) 236-8569	Price: $6.00

The Calculating Cook
by Jeanne Jones
San Francisco: 101 Productions, 1978
French sauces, Mexican dishes, curries, and other exotic food adapted for diabetic diet. Approved by the American Diabetes Association.

101 Productions	
834 Mission Street	
San Francisco, CA 94103	
or	
Charles Scribner's Sons	
Book Warehouse	
12 Breeland Avenue	Print
Totonia, NJ	Price: $5.95
and	
The Lighthouse for the Blind	
111 East 59th street	Braille
New York, NY 10022	Price: $34.00

A Cookbook for Diabetics
Pittsburgh: Forbes Health Systems, 1976
Recipes with exchange breakdowns; exchange breakdowns for commercial, processed foods.

Education Department	
Forbes Health Systems	Print
500 Finley Street	Price: $2.50
Pittsburgh, PA 15206	Postage: .50

American Printing House	
for the Blind	
1839 Frankfort Avenue	
P.O. Box 6085	
Louisville, KY 40206	Braille
(502) 895-2405	Price: $11.00

Cookbooks for People with Diabetes
Selected Annotations, Prepared by the
National Diabetes Information Clearinghouse, May 1981
Listing of 44 cookbooks published since 1976. Ordering information given.
National Diabetes Information Clearinghouse
805 15th Street, N.W., Suite 500
Washington, D.C. 20005   Print
(202) 842-7630   Price: Free

Craig Claiborne's Gourmet Diet
by Craig Claiborne and Pierre Franey
Haute cuisine: low salt, low fat, beefless recipes.
Print
Local bookstores, libraries   Price: $2.95/paperback
$10.95/hardcover

Regional Library for the Blind
and Physically Handicapped
or
Library of Congress
Division for the Blind
and Physically Handicapped
1291 Taylor Street, N.W.   Disk: Order No. RD 15781
Washington, D.C. 20542   Cassette: Order No. RC 15781

The Diabetic Gourmet
by Angela Bowen, M.D.
New York: Harper and Row, 1970
Family meals, diabetic recipes, emphasis on unsaturated fats. Carbohydrate, protein, fat content for individual portion.
Print
Local bookstores, libraries   Price: $10.95

Regional Library for the Blind
and Physically Handicapped
or
Library of Congress
Division for the Blind
and Physically Handicapped
1291 Taylor Street, N.W.
Washington, D.C. 20542   Disk: Order No. TB 3733

Diabetic Menus, Meals, and Recipes
by Betty M. West
Garden city, New York: Doubleday and Company, Inc.
Recipes with breakdowns for calories, vitamins, minerals, exchanges.
Doubleday and Co., Inc.
501 Franklin Avenue
Garden City, NY 11530   Print
(516) 294-4561   Price: $7.95
and
G.K. Hall
70 Lincoln Street   Large Print
Boston, MA 02111   Price: $12.95

The Diabetic's Total Health Book
by June Bierman and Barbara Toohey
Los Angeles: J.P. Tarcher, Inc., 1980
Balances various perspectives on diet provided by new trends in nutrition and insulin therapy; looks at exercise with diet and blood sugar control.
Sugarfree Center for Diabetics
5623 Matilija Avenue   Print
Van Nuys, CA 91401   Price: $10.95
Also available at local bookstores, libraries.

Diet and Nutrition: A Holistic Approach
by Rudolph Ballentine, M.D.
Honesdale, Pennsylvania: The Himalayan
International Institute, 1979
Basic explanation of physiology of food intake, digestion, and metabolism, including body's use of complex carbohydrates (whole grains, legumes, etc.) in holistic context.
Himalayan International Institute   Print
Honesdale, PA   Price: $8.95

Regional Library for the Blind
and Physically Handicapped
1291 Taylor Street, N.W.
Washington, D.C. 20542
(202) 882-5500   Cassette: Order No. RC 15777

Easy Cooking for One or Two
by Louise Davies
Written by specialist in geriatric nutrition. Emphasis on nonmeat protein.
Mrs. Audrey Artus
ADA Reading Service
12 Renhold Road   Cassette
Wilden, Bedford   To order: send self-addressed stamped
England   envelope with 2 C60 cassettes.
Telephone: Bedford (0234) 771693   Price: Free
and
Magna Print Books
Magna House
Long Preston, near Skipton
North Yorkshire BD23 4ND
England   Large Print
Telephone: Long Preston (07294) 225   Price: L5.50

The Elegant Touch Cookbook: Gourmet Cooking for the Diabetic
by Marjorie Zats and Karen Rubin
Minneapolis: Jonathan David Company
Classic European cuisine adapted to diabetic diet: menu suggestions, caloric values, exchanges, cooking hints.
Jonathan David Company
540 Taft Street, N.E.   Large Print
Minneapolis, MN 55413   Price: $9.45

Encore
compiled and recorded
by Library of Congress
A bimonthly "talking" magazine. Includes *Diabetes Forecast*, which contains articles on diabetes, recipes, resources, etc.
Regional Library for the Blind   Cassette available through
and Physically Handicapped   direct circulation.

Exchange Lists for Meal Planning
prepared by American Diabetes Association
Wide variety of common foods ranked in exchange lists according to food category and measure.
Volunteer Braille Services
P.O. Box 1592
Houma, LA 70361   Cassette
(504) 872-9658   Price: $5.00
and
Regional Library for the Blind
and Physically Handicapped
or
Library of Congress
Division for the Blind
and Physically Handicapped
1291 Taylor Street, N.W.
Washington, D.C. 20542
(202) 882-5500   Cassette: Order No. RC 165

Look 'N Cook
by Ida Erickson
Willmar, Minnesota: Biword, 1980

Includes chapter of recipes for diabetics. Hearty favorites (spaghetti, stew, macaroni and cheese) with exchange breakdowns.

Biword Publications — Large Print
Box 20 — Price $9.95
Willmar, MN 56201 — Postage & Handling: 2.00

Exercise

The role of exercise in diabetes control is less certain than that of diet. Generally, in providing information on diabetes control, medical professionals state that exercise is desirable, and they point out its blood glucose-lowering effects in conjunction with insulin; they mention that exercise can play an important part in the treatment of diabetes (Joslin's *Diabetes Mellitus*, p. 291). But the effects of exercise on blood glucose level are not consistent. It has been observed that sudden bouts of rigorous exercise, especially when they interrupt a sedentary life style or a period of inadequate insulin, can actually raise blood sugar. Extremely vigorous, prolonged exercise, such as mountain climbing under the extra stress of high altitudes, has likewise been observed to raise rather than lower blood sugars even with insulin adequate according to calculations and even with carefully prepared physical fitness (Oehler, *Diabetes Forecast*, 34(6), Nov/Dec 1981). It would appear that medical research is needed to continue efforts to describe the effects of exercise on diabetes under varying conditions.

Yet moderate and consistent exercise has been observed to lower blood sugar levels, to improve circulation, and to reduce stress. Resources for exercise programs follow.

Resources

Be Alive as Long as You Live: The Older Person's Complete Guide to Exercise for Joyful Living
by Lawrence J. Frankel and Betty Byrd Richard, 1980

Gentle exercise to be performed from standing, sitting, and lying positions to improve circulation, tone muscles, increase flexibility, relieve tension and stress.

Regional Library for the Blind
and Physically Handicapped
or
Library of Congress
Division for the Blind
and Physically Handicapped
1291 Taylor Street, N.W.
Washington, D.C. 20542
(202) 882-5500 — Cassette: Order No.

The Diabetic's Sports and Exercise Book
by June Bierman and Barbara Toohey
New York: J.P. Lippencott Co., 1977

Effects of exercise on mind, body, insulin requirements, diet; exercise programs; coping with insulin reactions.

Sugarfree Center for Diabetics
5623 Matilija Avenue — Print
Van Nuys, CA 91401 — Price: $10.95
Also available in local bookstores, libraries.

Sports and Exercise for People with Diabetes
Selected Annotations, Prepared by the National
Diabetes Information Clearinghouse, Jan. 1981

Annotated bibliography of print materials, educational films, and research studies on exercise and diabetes.

National Diabetes Information Clearinghouse
805 15th Street, N.W., Suite 500
Washington, D.C. 20005 — Print
(202) 842-7630 — Price: Free

Techniques for Foot Care by the Visually Impaired Diabetic

by

Allene R. VanSon, R.N.

A commonly experienced medical problem with diabetes is impairment of the healing process which can result in infection, especially in the extremities since blood circulation there tends to be more restricted. For the diabetic, then, foot care can become essential.

The material below is designed to encourage independence and self-management of compulsory foot care for the visually handicapped person with diabetes mellitus. The text addresses the consumer and aims to give step-by-step instructions in foot care.

Not only is your body changing because you are growing older; you have diabetes. Diabetes affects your blood vessels and nerve endings, including those in the feet and legs. Normally, blood travels through the arteries and veins carrying nourishment and oxygen to the cells and removes waste products. But in time these blood vessels can become narrow and plugged or hard and stiff, losing their ability to move blood easily. The resulting decreased circulation to the feet and legs can lead to a variety of complications. When nerve endings are affected by diabetes, pain can occur in feet and legs, especially at night. But actual sensitivity is decreased, which diminishes the ability to monitor heat, cold, and pain quickly; therefore, burns, frostbite, and injury can occur without awareness. Also there is a tendency for calluses and toenails to grow hard and thick, and these changes can lead to additional problems. Together these factors can produce ulcers and injuries that do not heal easily; further, gangrene can develop and result in amputation of toes, feet, or legs. Attention to foot care is an essential step in helping to prevent these serious complications.

Things You Can Do to Protect Your Feet

Control your blood sugar. Use meal plan, medication, and exercise designed to help keep blood sugar levels between 60 and 120 mg. fasting.

Wash feet daily unless skin is dry; then wash every other day. Check temperature of water by putting a drop on inside of wrist. If drop feels warm, but not hot, water is ready for use. *Do not* soak feet because soaking dries the tissues by washing out natural oils.

Use mild soap containing oil or lotion; Tone soap or Dermassage lotion are good choices.

Use a soft washcloth to rub off the dry skin gently.

Pat completely dry, especially between the toes.

Lubricate the skin at night with creams or lotions.

Check the condition of your feet daily. Gently run your hands all over your feet and legs. Note andy changes in the skin, e.g., dryness, callus formation, or injury.

Wear clean socks or stockings (hose) to protect your skin from the shoes. Hose with holes or mends may cause an injury.

Make certain that shoes fit comfortably and are in good condition. Remember that sandals and open-toed slippers do not protect your feet. Always use your hand to check the shoe for cracks, rough spots or objects before placing the shoe on your foot. Always "break in" new shoes by wearing them for one to two hours each day, for one to two weeks.

Take action if an injury occurs:

Small cuts: Stop the bleeding, wash with warm water, cover with dry sterile dressing. Seek help.

Blisters: Do not open the blister. Cover with a dry sterile dressing. Seek assistance.

Small burns: Immediately place burned area in cold water. Cover with a dry sterile dressing. Seek help.

Larger cuts and burns: Seek help.

Foot or leg ulcers: Give *special* attention. Follow *all* medical advice for soaking the area or applying medication and dressings. Enlist someone—a friend, relative, medical professional, etc.—to view the area daily.

Prevent burns! Use warm socks instead of hot water bottles, heating pads, or direct contact with radiator to warm feet.

Wear warm, dry boots to prevent frostbite in winter.

Keep toenails trim. File with an emery board; follow the curve of the toe. First soak feet in warm water for five to seven minutes to soften the nails before filing.

Things Someone Else Must Do to Protect Your Feet

A podiatrist or family member can file, clip, or cut your toenails following the curve of the toe. You can reduce the number of times you need help by using the emery board weekly.

Your feet and legs must be viewed at least once each week; a more frequent inspection is desirable.

Corns and calluses must be removed by a podiatrist.

Injuries require medical assistance.

Things to Do to Improve the Circulation in Your Feet and Legs

Develop a daily walking program with your doctor's permission.

Increase the distance and the rate of walking gradually. Use the heel-toe method of walking.

Do not sit still for long periods of time. Move about frequently. Wiggle your feet and toes while sitting.

Do not cross your legs.

Do not wear constricting garments or garters. They restrict the blood flow.

Nicotine slows the blood flow to your feet and legs; therefore, you are encouraged not to smoke.

It is your responsibility to take care of your feet and legs and to seek help when you need it, before a problem develops.

Resource

Time Out for Foot Care (anon)
Minneapolis: Metropolitan Medical Center, 1977

This is an illustrated outline of the Buerger-Allen exercises designed to increase foot comfort and improve blood flow to and from the feet. Eight guidelines to good foot care are also given.

Diabetes Education
Metropolitan Medical Center
900 South Eighth Street
Minneapolis, MN 55404
(612) 347-4654 Price: $0.25; $2.50/12

The Role of the Rehabilitation Center in Serving the Diabetic Person

by

Laura Marletta, M.Ed.

Not addressing the issue of diabetic control with the visually impaired diabetic in a rehabilitation setting is overlooking a major component of that person's rehabilitation program. If the diabetic client is not under the best possible control, that individual will not be able to work to the best of his/her ability. Participation in a rehabilitation program requires a great deal of physical stamina and mental alertness. The person with diabetes cannot afford to be feeling "sick."

Actually, control of the disease should be sought before the person is sent to a rehabilitation center. This effort could be coordinated by the rehabilitation counselor. A complete physical examination is part of the vocational rehabilitation process. The counselor could request specific information and recommendations from the physician on diabetes control. "Is the individual motivated toward good control?" Most large hospitals offer diabetes training programs. If the prospective client has not attended such a program, or it has been a number of years since attendance, the counselor should request the client attend a program as part of the total rehabilitation program.

Diabetic clients are not always unwilling to attend classes on diabetes; however, transportation and participation in the classes can be problems for the visually impaired person. The counselor should assume responsibility for alleviating these problems. Some people may get defensive when asked to attend such a class and state they know everything there is to know about diabetes. "After all, I have lived with it all my life!" However, if the onset of diabetes was during childhood, much information was perhaps learned indirectly at home twenty odd years ago. Much information has changed since then and is constantly changing as new developments are made.

In the past, much of the more technical information was withheld from the patient for fear of overburdening or frightening him. I believe ignorance of one's disease is what causes fear. Accurate information can provide the individual with the freedom to control his/her disease—preventing the disease from controlling the person.

A good time to review what is known about diabetes control is when the visually impaired diabetic enters the rehabilitation center. This can be done by anyone on the rehabilitation team possessing up-to-date, accurate knowledge about diabetes. Questions can be asked informally. For example: "What caloried diet are you on?" "How many exchanges are you allowed at each meal?" "How do you adjust for high urine/blood glucose tests?," etc. A more formal questionnaire can be devised to pinpoint areas where more knowledge is needed, or any problems the individual might be having with control.

Diabetics enrolled in a center program should be requested to wear identification stating they are diabetic. Medic Alert is an excellent form of identification. Also, as a remedy for possible unconsciousness due to hypoglycemia—low blood sugar or insulin shock—the diabetic should carry some form of quick sugar at all times. These two precautions protect both the client and the center. Diabetics should be encouraged to continue these practices at home.

Blood glucose/urine testing is essential for the diabetic. This is where a staff nurse would be helpful to perform this test before each meal and at bedtime. For some diabetics this might be the first time blood glucose has been checked regularly, and this would give them an idea of what type of control they are maintaining. Additionally, for those diabetics who are regularly checked at home, this service should be continued while at the rehabilitation center. Some professionals feel we are imposing our values on diabetic clients when we demand that urine/blood glucose be checked. I do not view this procedure as imposing values, but providing an environment for maintaining good health. Would a visually impaired person be allowed to travel outdoors without a cane while at the Center? The health risk is the same.

A diabetic who is not monitoring blood sugar/urine sugar levels has no idea what kind of control is being maintained. With the change in activity level while at the Center, insulin amount/diet may have to be altered. The only way to know how much is by testing. Many diabetics say to me "I know how my blood sugars are running by the way I feel." By the time the person starts to feel the effects of elevated blood sugar, the sugar level has been high for a while. Once blood sugar is elevated, it is much harder to bring it down. More importantly, the person runs the risk of going into acidosis (dehydration) and if untreated, diabetic coma, which is a life-threatening condition. On the other hand, running a consistently low blood sugar can impair judgment and impede the learning process.

An area where rehabilitation centers can really fall down in accommodating the diabetic is diet. The food that is often served in these institutions is not conducive to the diabetic diet and overall good control. Typically, the food is high in starch and sugar and low in fresh vegetable and fruit, lean protein sources and complex carbohydrate. A meal I was served at one such institution consisted of a large plate of spaghetti with meat sauce (very little meat and the sauce tasted sweet), garlic bread, a small salad, and cake. The meal was mostly starchy carbohydrate. A diabetic eating that meal would probably leave the table with an extremely elevated blood sugar. Rehabilitation centers must start serving more nutritious meals, which would be better for everyone. A diet rich in fresh or frozen vegetables (plain), complex carbohydrate such as whole grains and legumes, lean meats and fish and fruit is much better.

The rehabilitation teacher plays an important role in teaching the diabetic client good nutrition. Once a diet has been prescribed, the R.T. can review it with the client and go over what is included in the different exchange lists. The diet should be put in a form that is easily read by the client. Eventually the person should have the diet memorized. Reviewing portion sizes with tactile models is very helpful. For example, a three-ounce piece of chicken is about this big. The principles of preparing meals from scratch as opposed to relying on prepared foods is essential for the diabetic to maintain good control. (Many prepared/packaged foods contain high levels of sugar and salt.)

The R.T. also teaches the use of insulin measuring devices. This should be done in conjunction with a nurse to be sure the proper procedure is used. In my work as an itinerant rehabilitation teacher, I have observed many people, diabetics of long duration, incorrectly drawing up the insulin dose, particularly with a mixed dose.

In summary, if the rehabilitation center is addressing the areas of mobility, communications, personal hygiene, housekeeping, etc., is not management of health just as important? Actually, control of diabetes is necessary before anything else can be learned. The issue of striving for good control of diabetes is still debated by many physicians, so the confusion many diabetics have about their diabetes is understandable. However, more and more of the literature on diabetes points to the benefits of maintaining near normal blood glucose levels. People coming to the rehabilitation center have lost their eyesight; possibly, addressing the issue of good control can prevent further complications and prolong a more productive life.

Further Resources for Rehabilitation Teachers

Diabetes Teaching Guide
by George P. Kozak, M.D.
Boston: Joslin Diabetes Foundation, 1977.

Instructions for urine sugar testing, the diabetic diet, insulin use and administration techniques, symptoms of and remedies for hyperglycemia (high blood sugar) and hypoglycemia (low blood sugar), managing insulin and diet on sick days, etc. A revised edition planned for Fall 1982 will discuss home blood glucose monitoring. The text is written for newly diagnosed or recently hospitalized diabetics.

The Joslin Clinic
One Joslin Place
Boston, MA 02215
(617) 732-2539
Print.
Price: $4.00

Joslin Diabetes Manual, 11th Edition
Edited by L.P. Krall
Philadelphia: Lea and Febiger, 1978.

Information on diabetes including illustrations, charts, photographs.

Lea and Febiger
600 South Washington Square
Philadelphia, PA 19106
(215) 922-1330
and
The Joslin Clinic
One Joslin Place
Boston, MA 02215
Print.
Price: $8.50 (English)
$13.50 (Spanish)
or
G.K. Hall
70 Lincoln Street
Boston, MA 02111
Large Print.
Price: $24.75 (2 volumes)

Materials and Aids for the Visually Impaired Diabetic
Prepared by the National Diabetes Information Clearinghouse
July 1980

A bibliography of information on diabetes-related visual impairment, it lists 114 items in various media and includes devices with price and ordering information.

National Diabetes Information Clearinghouse
Box NDIC
Bethesda, MD 20205
(301) 496-7433
(202) 842-7630
Print.
Price: Free.

Special Devices and Equipment for the Visually Impaired Diabetic
Prepared by R. Keith Campbell
American Pharmacy
Washington, D.C.: American Pharmaceutical Association, 1981.

It evaluates some urine testing systems and magnifiers (as well as such technologically advanced aids as the Optacon).

Vision Foundation, Inc.
770 Centre Street
Newton, MA 02150
1-800-852-3029
1-617-965-5877
Cassette.
Price: $2.00

Teaching Guides for Diabetes Education Programs: Selected Annotations
Prepared by National Diabetes Information Clearinghouse
June 1979

A bibliography of materials which are instructional vs. simply informational, useful to health professionals in designing programs, or useful to patients and families as a study guide.

National Diabetes Information Clearinghouse
Box NDIC
Bethesda, MD 20205
(301) 496-7433
(202) 842-7630
Print.
Price: Free.

You, Your Eyes and Your Diabetes
by Donna L. Johnson
Winnetka, Illinois: The Hadley School for the Blind, 1981.

Written for the diabetic who is experiencing vision loss, the book provides information about the condition, diet, exercise, insulin management, and preventive medicine in diabetic control.

The Hadley School for the Blind
700 Elm Street
Winnetka, Illinois 60093
1-800-323-4238
1-800-942-4193 (Illinois residents)
Jumbo Braille.
Large Print.
Cassette.
Borrowed as part of correspondence course.

Views of a Blind Diabetic

by
Davide Marletta, M.Ed.

I have been a diabetic for the last 27 years, legally blind, eight, and totally blind, three of the last eight. Much to the amazement of sighted, nondiabetics, I often think and say that I would rather be blind than diabetic. I guess the main reason for this attitude on my part is that I know what to expect from my blindness and have many aids and appliances to choose from to help me perform activities in both my personal and professional life. However, there seems to be much that still has to be learned about diabetes; the future, although promising, is still not definite. More and more of the literature these days seems to indicate that proper control of diabetes either prevents or minimizes complications. However, there still seems to be some disagreement over just what good control entails. Attitudes sometimes seem to change so fast that it is often difficult to stay on top of things. I can recall many years ago that I was instructed to spill sugar in the urine before going to bed in order to avoid insulin reactions during the night. Today, the emphasis is to stay as much within the normal range of blood glucose as possible. Although I am trying to do this, and have felt better for it, I still come across other diabetics and health and rehabilitation professionals who maintain that it is not possible for an insulin dependent diabetic to achieve near normal blood glucose levels or that reactions are to be avoided. Personally, I think that reactions once in a while are not bad; it indicates to me that my body is making full use of all the food that I am eating. (Of course, if reactions persist, then I must make some adjustments in either insulin or diet.)

Since what we know about diabetes today is more than we knew years ago, I cannot take all the blame for my diabetic retinopathy. However, I must admit that there was a good amount of cheating on my part. I think I was trying not to have my diabetes run my life; unfortunately, this took place through totally denying its existence rather than attempting to maintain proper control. Even after going through four months at a rehabilitation center, and learning how to use devices for measuring insulin myself, I blamed the diabetes for everything. At one point I actually believed that while I needed insulin to live, its constant use was also killing me; I thought that I had about five years left to live. With an attitude like that, it is no wonder that I continued to cheat knowingly.

It was at this point that I met two great women. One was the woman I would eventually marry; the other was the diabetic teaching nurse at the local medical center. I remember my girlfriend saying that she was glad to help me with my diabetes, but that it was my condition and I would have to accept some responsibility for it. Then, through the nurse, I learned that I was not dying and could live a good life if I would just take care of myself. The prospect of perhaps losing the woman I loved was the incentive I needed to try and get my act together. Although I thought none of this control business would work, I decided to give it a try. Surprise of surprises—I felt better, got good reports from my doctor, had better dental checkups. I began to get control of my actions and therefore my life. Today, I am happily married, successfully employed, get good medical checkups, and, in the last year, have become a father for the first time.

I am still striving for that sometimes unreachable goal: always having a blood glucose of sixty to one hundred twenty. However, in striving for it, I feel well, remain healthy and, surprisingly enough, find I have more freedom. That is, by knowing my diet, the exchanges, and how my insulin works, I find that I can make the necessary adjustments in an effort to maintain optimum control.

Admittedly, I do find that my diabetes is pretty constant on my mind. Now that I take three shots a day, I find I am very conscious of the time, so that I might take my shot at the proper time. When I eat out, I constantly am trying to figure out all the exchanges for that meal; sometimes this means not always eating exactly what I want. How nice it would be to go to a restaurant sometime and just pig out!

And, unfortunately, the issue of blindness and diabetes is not always so positive. To be honest, blindness itself is negative, even though with a lot of effort and support, it can be used in a positive manner. In my mind, diabetes is *never* positive. I see it as a potentially destructive disease. While more evidence points to good control being the key, who can say what the findings will be ten or twenty years from now? As if being diabetic was not enough, being blind on top of it makes it virtually impossible to be completely independent. At present, there are no devices available allowing me to draw my own syringes since I use low dose syringes; I have found no way that I can monitor either urine or blood sugars myself. For these things, I absolutely have to depend upon sighted help; fortunately, my wife is willing to do this for me. The idea that continuing to have elevated blood sugars might lead to even more complications is very frightening, to say the least. Because adolescence is hard enough, I dread the possibility of our son becoming a diabetic and having to deal with growing up in that context.

But, most significantly, I continue to be mostly optimistic that I can obtain good control and maintain it for the rest of my life; in the meantime, I feel great and just wish that they would hurry up and cure diabetes.

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About Contributors to Issue No. 6 of AAR

Ruth B. Carr, R.N. is Head Nurse of the Eastern Blind Rehabilitation Center, Veterans Administration Medical Center, West Haven, Connecticut. Part of her work is to teach the use of insulin gauges, needle guides, and vial holder in self-management of diabetic control with vision loss.

Brian Collins of Toronto, Canada is a student of nutrition. As a consumer with diabetic retinopathy, he shared with us his personal experience and evaluations of self-management of diabetic control with vision loss.

Richard M. Connors, M.Ed. is Supervisor of Community Services at The Carroll Center for the Blind, Newton, Massachusetts. He oversees the teaching of orientation and mobility in the community and is concerned with diabetic care and the teaching of self-management of diabetic control in the field of blindness rehabilitation.

Donna L. Johnson, instructor at The Hadley School for the Blind in Illinois, is the author of *You, Your Eyes and Your Diabetes*, the central text in a correspondence course for persons with diabetes and vision loss.

David Marletta, M.Ed. works in blind services as a personal adjustment couselor at the Maine Center for the Blind. His interest in and knowledge of diabetic control with vision loss is both professional and personal.

Laura V. Marletta, M.Ed. is Supervisor of Rehabilitation Teachers at the Maine Center for the Blind. Her previous publications include contributions to the Newsletter of Rehabilitation Teachers of the Northeast Chapter of A.A.W.B.

Judith W. Oehler, R.N., Ed.D. holds the position of assistant professor in the School of Nursing at the University of Wisconsin at Milwaukee. Dr. Oehler is the author of articles on diabetes appearing in professional and medical journals; most recently Dr. Oehler has been involved in the formation of a new publication, the *Journal of Opthalmic Nursing and Technology.*

Alice Raftary, M.Ed., Supervisor of Teaching, Greater Detroit Society for the Blind, is the author of the widely read and used manual *Modifications on Insulin Techniques for the Visually Impaired or Blind Diabetic*, from which her article in this issue was excerpted, with her kind permission.

Joyce Schulz, R.N., known for her previous articles on diabetic control with vision loss in such publications as the *Journal for Visual Impairment and Nursing*, teaches diabetes maintenance to clients at the Minneapolis Society for the Blind.

Allene R. VanSon, R.N. is associated with the Erie County Medical Center in Buffalo, New York where she teaches the self-management of diabetic control; she is the author of *Helping the Blind Measure Insulin* and another valuable manual, *Stop! Look! Listen!*, which gives instructions for diabetic foot care.

AIDS AND APPLIANCES REVIEW

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770 Centre Street, Newton, MA 02158
(617) 969-6200

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DIABETIC CONTROL: EQUIPMENT FOR USE WITH VISION LOSS

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Introduction

by
Donna L. Johnson

The person experiencing the condition known as diabetes mellitus soon learns that living and growing in harmony with it requires adaptation of lifestyle to meet the body's needs. It is important for the diabetic to learn to live, and grow, and enjoy life as naturally and independently as possible, yet as a conscientious diabetic. It is only by working with the body and not against it that the person can hope to achieve maximum health. To be successful, he or she must be educated about and willing to adjust to the necessary modifications now required to keep the body functioning as stably as possible. He or she needs to know about the causes, symptoms, and treatment of a very high or very low blood sugar; he or she needs to know how injected insulin, food intake, exercise, and stress affect the level of sugar in the blood in order to plan and carry out the tasks of diabetic control: monitoring glucose levels, proper food management, and corresponding insulin adjustments.

Even with conscientious attention to adapting lifestyle to the body's needs, the diabetic can experience serious long-term medical complications. Among them are cataracts, glaucoma, and diabetic retinopathy—a disease which affects the small blood vessels on the retina. For those persons experiencing legal blindness because of these eye complications, learning to continue living in harmony with their diabetes is still important. This harmony can be attained by gaining a better understaning of the condition itself and by learning to use special aids and appliances in place of eyesight: various special syringes and gauges for measuring the insulin; enlarged test tapes, charts, or audible analyzers for urine-glucose monitoring; brailled or taped diabetic diets, meal plans and cookbooks.

To assist the visually impaired diabetic in gaining this education, it is essential for the person working with him or her in rehabilitation to gain a basic knowledge of the diabetic's individual physical and psychological needs. Although diabetics share common traits, each person remains unique, with special, individual rehabilitative needs. It is imperative for the rehabilitation community to respond appropriately to these needs to make a positive difference in lives of persons with diabetes and vision loss.

Editor's Note

Diabetic control, with sight or with vision loss, is a complex procedure. Maintaining control of blood glucose levels—the central task—requires careful dedication to a routine which, to say the least, can impinge on very human desires to live spontaneously and to follow impulses—impulses to do what everyone else is doing, maybe just filling up on McDonald's french fries when the rest of the gang does it so harmlessly. But with diabetes such impulses can lead to the high levels of blood glucose characteristic of the condition—with damaging results.

Besides corralling such impulses, good diabetic control requires harnessing energy into a network of daily routines. Daily life must fit the routines of testing urine or blood for glucose as often as four times per day; measuring and injecting insulin at least once, and for some people, four times per day; and eating in accordance with an unvarying schedule of meal times and precisely planned menus. The regimen is intricate. Even with sight, handling it successfully demands a high degree of motivation, commitment, knowledge, and skill.

Ordinarily, in fact, sight is critical to the tasks of diabetic control: to test for glucose in urine or blood, a color change on a narrow reagent strip must be matched to the colors of a glucose percentage chart; the fine-line unit scale on the syringe must be read accurately to draw up the insulin dose for injection; to maintain the prescribed diet, ingredients and food portions must be measured in calibrated cups or spoons or weighed on a scale meant to be read with sight. The necessity for special, nonvisual devices and adapted techniques can become urgent with vision loss, a potential complication of diabetes. This issue of AAR aims to provide up-to-date product information about much of the available equipment designed for management of these tasks with vision loss; in addition, it includes blood glucose testing equipment, not yet adapted for use without sight. Of course, these devices must be used with knowledge of diabetes itself.

However, AAR does not pretend to make any steadfast pronouncements about diabetes or diabetic care. Within the field of diabetic care, controversy continues over such crucial topics as the best methods of insulin delivery and the role of high blood glucose levels in causing diabetic retinopathy. Few issues are settled. Given this present lack of orthodoxy, even approaching an understanding of diabetes can be a complicated undertaking with an uncertain outcome.

We would stress that no part of this issue should be taken as medical advice; we present all material about diabetic care in hope that it will provide points of departure for a continuing search for better understanding of diabetes and its control. Some, or much, of this material may differ from the clinical practices of some established medical centers—since variance in approach is a fact of diabetic care. And approaches and techniques described in this issue may well differ from the prevailing habits of blind diabetics embarking on a course of learning therapeutic techniques anew with vision loss. Recognizing such conflicts, we present all material on diabetic care per se advisedly. We offer it to those in the field of blindness rehabilitation who would begin to learn about diabetes and diabetes care as a necessary context for evaluating the devices and techniques which may be useful to the blind diabetic in the rehabilitation setting: aids for insulin administration, for blood and urine monitoring, for diet and exercise management.

To provide the background for the articles on aids, Issue No. 6 of AAR begins with an explanation of the condition and a brief history of insulin therapy.

Robert McGillivray
Marlene Gast

INSULIN THERAPY

Diabetes: Some Physiological Considerations for the Blind Person

by

Richard M. Connors, M.Ed.

The existence of numerous "Fifty Year" diabetics testifies to the fact that diabetes can be controlled; essentially normal lives can be lived with it.[1] For this to be so, however, the condition must be understood, faced for what it is, and dealt with. It is the goal, hopefully, of those of us involved in the rehabilitation of the blind diabetic to help him develop a state of health and continued expectation of health in which he himself will be the prime participant.

Advances in our understanding of the disease and important technological advances like home blood glucose monitoring have at last made this ideal possible.

Diabetes is not an easy disease to understand. The variety and complexity of books currently available on the subject amply demonstrate that. Many of these books are very good and treat the mechanics of control in great depth. This brief article does not seek to take their place. Rather we will try here to draw the reader's attention to some simple facts and illustrations which may contribute something to an overall understanding of the disease and give a framework for the material to follow.

Diabetes is defined as the state caused by insufficient available insulin.[2] Long ago it was noticed that there are two major forms of the disease. Various terms have been applied to these forms over the years: juvenile-onset and adult-onset; Type I and Type II; insulin dependent and non-insulin dependent. The latter terms are the ones in current use and reflect the present understanding of the condition. Insulin-dependent diabetes *tends* to have its onset among juveniles (hence the original term for it), but is now being called insulin dependent because that appears to be the salient characteristic: control cannot be achieved without daily injections of insulin. Non-insulin dependent diabetes, on the other hand, responds well to weight loss, diet, exercise, and oral medications. Since insulin-dependent diabetes is overwhelmingly the form we deal with among the blind, this article will confine itself to the insulin dependent form.

Insulin is a hormone produced in the pancreas. It must be present in order for sugar circulating in the blood to pass through the walls of the blood vessels and reach the body tissues. Since sugar is the body's fuel or energy supply, the breakdown in sugar metabolism which occurs in diabetes is life-threatening unless corrected.

The body is a self-regulating system, with constant back-and-forth communication going on among the various parts of the system. Normally, sugar and insulin exist in harmonious balance. When a low level of sugar exists in the body's tissues, the perception of a need for food arises. Appetite is stimulated; we feel hungry; we eat. As we do, the resulting rise in blood sugar stimulates the release of insulin. Interaction of insulin and blood sugar allows the sugar's passage into the tissues. Hunger is slaked; eating stops; excess sugar is transformed into fatty substances for storage. Insulin release gradually shuts down; the system returns to static equilibrium. This interaction between sugar and insulin can be roughly diagrammed as follows:

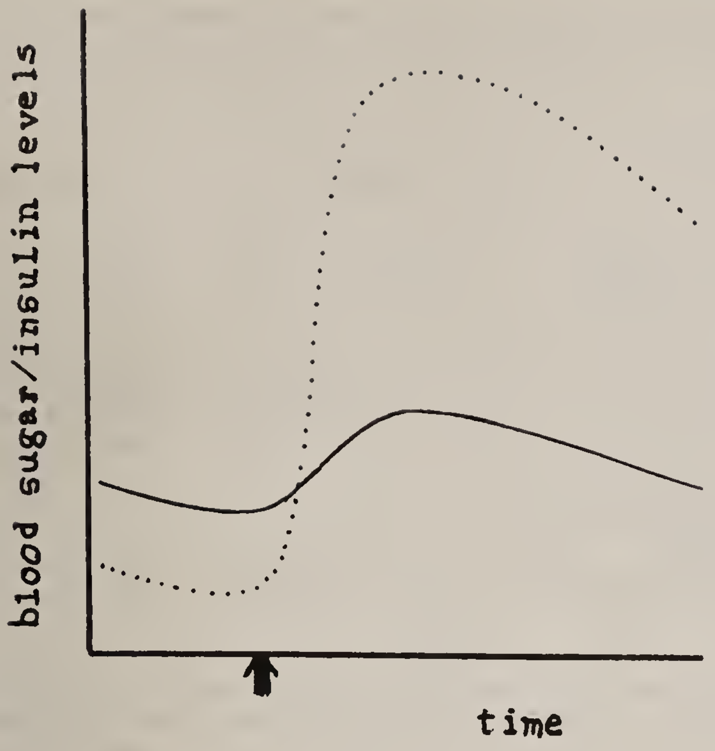


Figure 1 Insulin/blood sugar variations in a non-diabetic at meal time. Note the very great variation in insulin level.

In diabetes the blood sugar/insulin mechanism is impaired, and MAXIMUM POSSIBLE release of insulin is still not enough. Sugar stays in the blood rather than moving from there into the tissues where it is needed. It accumulates, sometimes to enormously high levels. Figure 2 diagrams this situation, and shows an insufficient supply of pancreatic insulin, as do all subsequent illustrations in this article. Insufficient SUPPLY of insulin, however, is not always the problem (see note 3).

The very high level of blood sugar shown in Fig. 2 means that sugar which should be reaching the body tissues is not. Tissues which thus remain essentially unfed continue to create a state of hunger. The person goes on eating, therefore, well beyond the point where he would normally stop. This is the condition called "polyphagia," or excessive eating, and it represents a state where the body is quite literally starving in the midst of plenty.

If this condition of starvation despite eating goes on for long, the person may eventually lose consciousness, entering the state called "diabetic coma." In coma the body is metabolizing its fat reserves very quickly in a desperate attempt to feed itself. Fat, however, does not metabolize cleanly; byproducts called ketones are created and these, as they accumulate, act like strong poisons. They may eventually cause loss of consciousness; if the person remains untreated, death is a possibility.

The opposite condition from diabetic coma, insulin reaction, or hypoglycemia, may also cause a loss of consciousness. Where diabetic coma follows upon a state of abnormally HIGH blood sugar, insulin reaction, however, follows upon too LOW a level of blood sugar. Insuln reaction can result from a variety of factors, including not eating enough food to "balance" the injected insulin, a sudden surge of unusual physical activity, or taking too much insulin by mistake. Although loss of consciousness can take place with insulin reaction, it is seldom a life-threatening crisis, and ample opportunity generally exists for the person to treat the reaction with sugar-containing food. That is all that's necessry—eating something with quick-acting sugar in it. Orange juice is excellent.

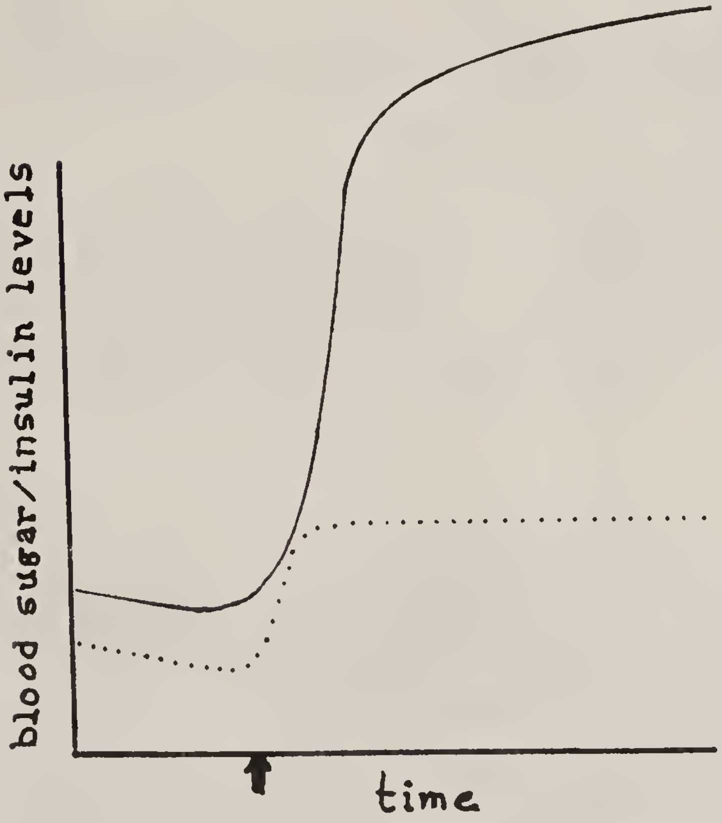


Figure 2 Insulin/blood sugar levels in an uncontrolled diabetic. Note that as blood sugar begins to rise with food intake, so does insulin. Insulin rise, however, stops far short of the level needed, and blood sugar continues to rise to a much higher than normal level.

Fig. 3 shows a possible course of blood sugar variations over an entire day in the case of an uncontrolled diabetic. Note that every time food is eaten (arrows) blood sugar simply goes higher, and afterwards falls only very sluggishly. As long as SOME pancreatic insulin is available so that body tissues obtain SOME of their needed sugar, coma will generally not occur despite what may be extremely high blood sugar.

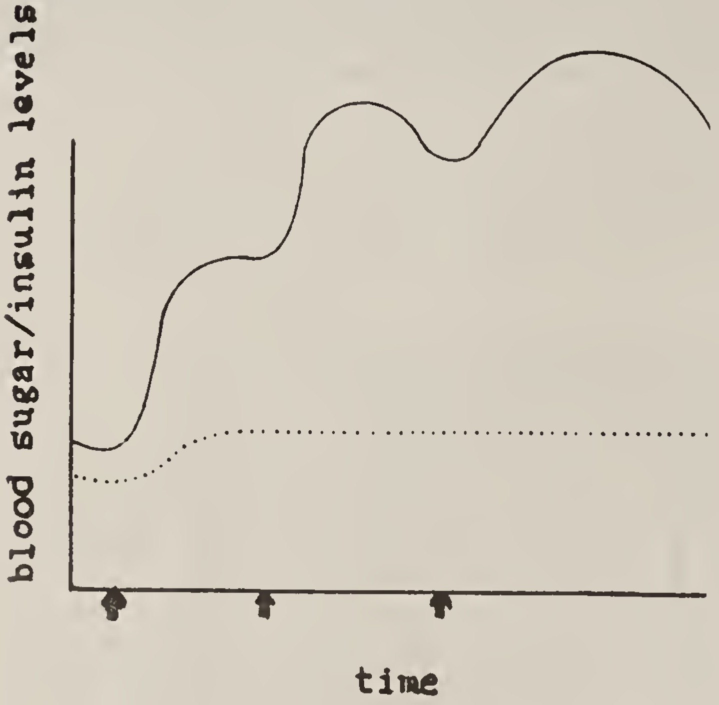


Figure 3 Possible blood sugar variations in an uncontrolled insulin-dependent diabetic. Note that an impaired pancreatic output is assumed here: food intake (arrows) has no effect on insulin supply, and blood sugars simply increase every time food is eaten.

—— blood sugar
.... pancreatic insulin
▲ food intake

When insulin first became available in the 20s, there was only one form of it: what we now know as "regular." This fast-acting, short-duration insulin, essentially the same as the insulin released by the body's own pancreas, needed to be injected three or four times per day to achieve control. While this kept alive many people who would otherwise have died, and while diabetics could then begin to live essentially normal lives, many did not welcome the need to inject themselves several times a day. Beginning in the mid 30s, therefore, a succession of time-release insulins came onto the market attempting to address this problem. PZI, NPH, lente, and other slower-acting insulin seemingly solved a major problem for many diabetics by making it possible for them to inject only one daily dose, instead of four. Eventually many new types of insulin found their way to the market and enabled physicians to pick whatever type seemed best for individual patients. Table I summarizes the types commonly available at present.

TABLE I: Types of insulin currently available with their characteristics of action.

TYPE & APPEARANCE	*ONSET*	*PEAK*	*DURATION*
Fast-acting			
Regular (clear)	½ hr.	2-4 hr.	6-8 hr.
Semilente (cloudy)	1½ hr.	4-7 hr.	12-16 hr.
Intermediate			
Globin (clear)	2 hr.	10-14 hr.	14-22 hr.
NPH (cloudy)	1 hr.	10-16 hr.	18-30 hr.
Lente (cloudy)	1 hr.	10-16 hr.	18-30 hr.
Slow-acting			
Protamine Zinc/PZI (cloudy)	6 hr.	14-24 hr.	24-36 hr.
Ultralente (milky)	5 hr.	20-26 hr.	36+ hr.

There seems to have been a widespread impression from about the mid-30s until quite recently that these time-release insulins had solved the diabetic's problem for all intents and purposes. This impression apparently grew stronger when oral medications became available in the 50s. Suddenly many people could get by without shots at all. Evidence was slowly accumulating, however, that all was not well with this "single-dose" insulin therapy. Distressing numbers of diabetics were experiencing one or more of the complications of the disease: nerve, kidney, and eye damage. Those who believed that very strict control of blood sugar could help avoid these complications gradually won their case. A major factor in the development of complications was eventually recognized to be chronically high blood sugars. And to some extent the long-acting insulins were responsible. Consider Fig. 4.

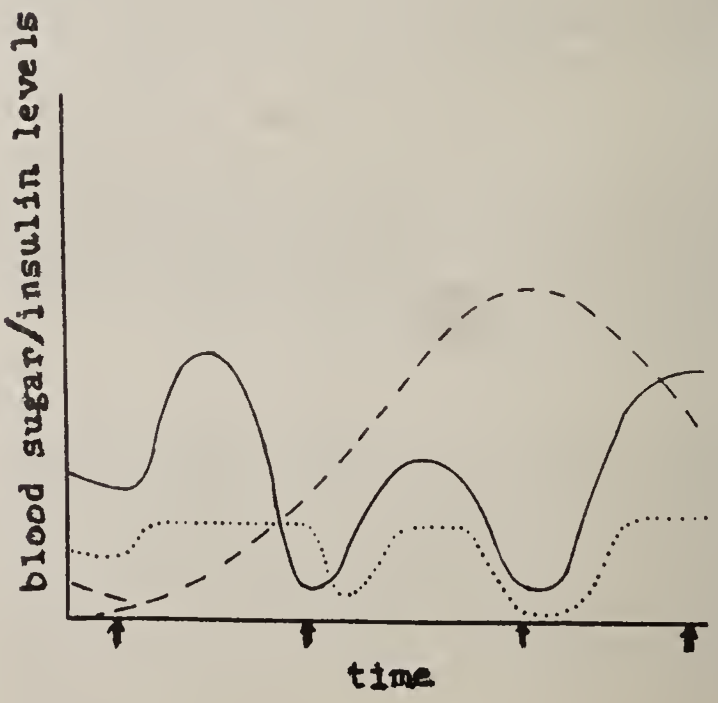


Figure 4 Effect of a single morning dose of long-acting (e.g., NPH) insulin on blood sugar in an insulin-dependent diabetic. Note the sharp rises in blood sugar in the morning (first arrow, breakfast) and evening (third arrow, supper; fourth arrow, bedtime snack).

—— blood sugar
.... pancreatic insulin
--- NPH insulin
▲ food intake

In this illustration blood sugar is shown by the solid line and the impaired pancreatic insulin output by the dotted line as before. Injected time-release insulin (e.g., NPH) is shown by the dashed line. Note that even though the injection is taken before eating breakfast (the first arrow on the left), it does not begin acting to any significant extent until considerably later. After breakfast, therefore, blood sugar shoots up and doesn't fall until late in the morning. When it falls, it plunges, then stays reasonably low as it works efficiently with lunch (the second arrow). Supper—the third arrow—is generally eaten at a time when the injected insulin has begun to decline in activity. Since, in this country, supper tends to be the biggest meal of the day and to contain large amounts of protein and fat, this presents problems. The digestion of what tends to be a typical American supper will not be complete until after the injected insulin is nearly all used up. Digestion goes on, however, and blood sugar builds up. Adding to the problem still further is another American habit of nighttime snacking (the fourth arrow). Thus is is probably not at all uncommon for many diabetics to spend all night and a good part of the next morning with high blood sugars. And this despite frequent insulin reactions in the late morning and afternoon which incline them to think they're well controlled!! One physician has called this single-dose therapy, which was popular for decades, "...the worst thing that ever could have happened to diabetes...many juvenile diabetics who were on long-acting insulin for twenty years or more are now blind, sick, and dying."[4]

While single-dose therapy apparently is perfectly appropriate for some diabetics, apparently, for others it is a thing of the past. The original regimen from the 1920s of many daily injections of regular insulin has now, in effect, returned with the advent of the insulin pump. While its use is not yet widespread at this writing, it shows promise that it soon will be. The pump delivers its insulin not in a small number of large doses the way separate injections do, but in a large number of small doses, more like the way the pancreas functions. For many insulin dependent diabetics, the therapy that appears to best meet their needs is a multiple-dose regimen of mixed insulins. A typical daily routine of this type might involve a morning dose of, for example, NPH and Regular, and an evening dose of the same insulins in different amounts. The effects that can be achieved with this sort of therapy are shown in Fig. 5.

Here, the morning and late evening rises in blood sugar diagrammed in the previous figure are smoothed out by doses of regular insulin (dash/dotted line), with the longer-acting NPH dose (dashed line) taking care of the midday blood sugar. Blood sugar resulting from this therapy (solid line) shows gradual up and down waves staying more or less within normal limits. At any given moment the amount of insulin available for work is the SUM of the fractional doses of pancreatic, NPH and regular.

The problems facing the visually impaired diabetic, then, are how to measure accurately these often-complex doses of insulin, and how to monitor blood sugar levels. Technological advances, some very recent, have finally brought these problems within reach of a solution.

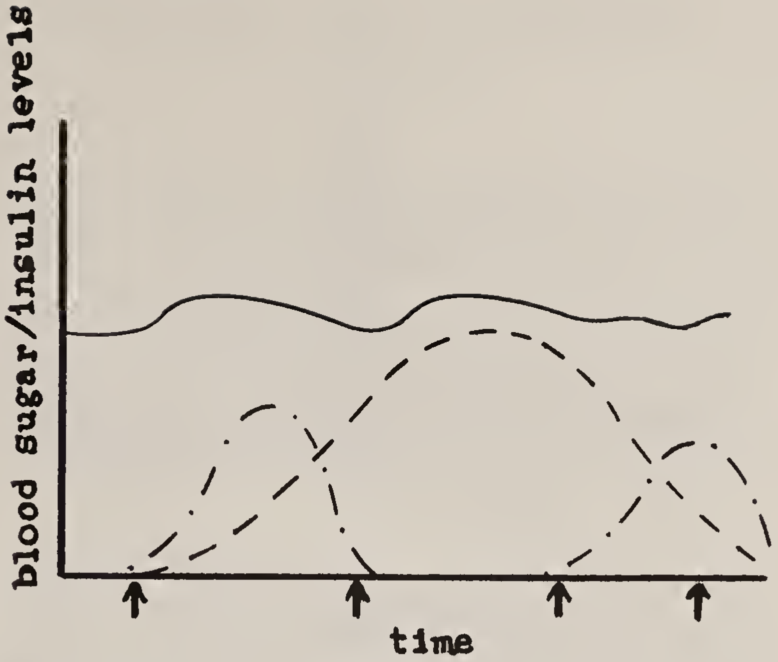


Figure 5 Example of multiple-dose therapy. Body's own pancreatic insulin is not shown for the sake of clarity. The doses of regular insulin before breakfast and again before supper fill in the gaps left by the NPH.

—— blood sugar
---- NPH insulin
–.– regular insulin
🠉 food intake

NOTES

[1] Cochran, H.A., Jr.; Marble, A.; Galloway, J.A. "Factors in the Survival of Patients with Insulin Requiring Diabetes for 50 Years," *Diabetes Care*, Vol. 2, No. 4, pp. 363-8, July-August, 1979.

[2] Krall, Leo. *Joslin Diabetes Manual*, Eleventh Edition. Philadelphia: Lea & Febiger, 1978, p. 5.

[3] In some cases the diabetic is observed to have a normal, or even above normal, supply of insulin. The problem appears to be that the body cannot use some of the insulin present in the blood. The reason for this is not fully understood.

[4] Goodman, Joseph. *Diabetes Without Fear*. New York: Avon, 1978. p. 28.

Basic Equipment for Insulin Administration

by

Ruth B. Carr, R.N.

In managing insulin administration, insulin and insulin syringes have served as basic equipment since 1922 when insulin, isolated from the pancreases of cattle or pigs, was first injected into humans for the treatment of diabetes mellitus. Even with recent developments in insulin delivery, such as the insulin pump, syringes and vials of pork or beef insulin remain the basic equipment. Much of the following discussion will prove familiar to those already acquainted with this basic equipment. However, it also contains a brief description of the "new insulins" which may bring to light some of the implications for their use in insulin administration with vision loss.

Commercial insulin is contained in a glass vial, permanently affixed with an aluminum cap, which is in turn centered by a tiny rubber diaphragm. The rubber diaphragm permits penetration by the hypodermic needle of the insulin syringe so that the insulin may be withdrawn and measured for injection. Insulin vials may have different shapes, but all insulin vials have the same spatial volume—10 cubic centimeters; they also contain the same volume of liquid—10 milliliters. For example, the Danish insulin Novo is sold in a tall, narrow vial in both Europe and the United States while American insulins (Lilly and Squibb) come in relatively squat vials; yet these vials all contain 10 milliliters of liquid in 10 cubic centimeters of space.

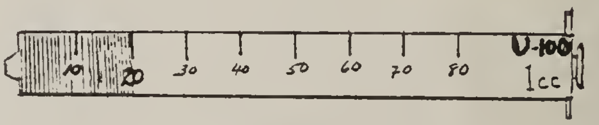
Even though all commercial insulin vials contain the same amount of liquid, concentrations of insulin within the total liquid vary. The insulin vial does not contain pure insulin but rather a portion of pure insulin, measured in "units," combined with other compounds in liquid form. Variations in concentration result from the fact that the amount of pure insulin combined with the other liquid in the vial can be increased or decreased compared to that other liquid. Therefore, all insulin vials are not only labeled to show the form of insulin contained (Regular, Semilente, Globin, NPH, Lente, PZI, or Ultralente); they are also labeled to indicate which of the three commercially available concentrations of insulin is contained.

Presently, the concentrations of insulin on the market are U-40, U-80, and U-100. The terms refer to the number of units of insulin incorporated in each milliliter of liquid: U-40 contains 40 units of insulin incorporated into each milliliter of total liquid in the vial; U-80 contains 80 units per milliliter; U-100, 100 units per milliliter. Clearly, the amount of insulin compared to the amount of liquid in which the insulin is mixed is greatest in a vial labeled U-100; in other words, U-100 insulin is the strongest commercially available insulin. In the near future, the only strength of commercially available insulin will be U-100; already U-80 insulin has been phased out.

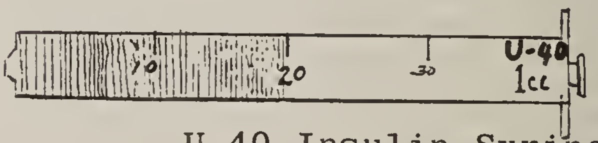
The single available insulin strength should prove fortunate, since the availability of three different concentrations has been known to contribute to dosage error. Even though dosage error from this source may soon be a thing of the past, an explanation of it seems warranted since the problem could persist during the transition to the uniform concentration of U-100 insulin.

In order to understand the problem it is first necessary to know that each of the three concentrations has its own syringe, specially calibrated for that concentration only. To administer an accurate dose of insulin, *only* a U-100 syringe can be used with U-100 insulin; *only* a U-40 syringe can be used with U-40 insulin; and *only* a U-80 syringe was to be used with U-80 insulin. (As an alert, the different syringes are not only *labeled* according to concentration but also *color-coded:* a U-40 syringe is marked in red, U-80 in green, and U-100 in black.)

For an illustration of how dosage error can occur with the availability of various concentrations, consider how the standard 1 cubic centimeter syringe would be differently calibrated for U-100 insulin and for U-40 insulin. The figure below shows that the mark for a 20 unit dose of insulin is at the half-way point on the U-40 syringe, while on the U-100 syringe, the 20 unit mark is at a point 1/5 the total volume of the 1 cc syringe.



U-100 Insulin Syringe



U-40 Insulin Syringe

Figure 1

The relationship may be explained as follows: full, a 1 cc syringe of U-100 insulin would contain 100 units of insulin; to administer 20 units of insulin, then, the 1 cc syringe would be 1/5 full since 20 in 1/5 of 100. A 1 cc syringe full of U-40 insulin would contain only 40 units of insulin; thus a 20 unit dose of insulin using the U-40 concentration in a 1 cc syringe would be exactly 1/2 cc, making the syringe half-filled exactly. Now consider the possibilities of dosage error by mistakenly using a U-40 syringe to draw up U-100 insulin for an intended 20 unit dose. The 20 unit line on a 1 cc U-40 syringe would mark the halfway point, 1/2 cc; but 1/2 cc of U-100 insulin would be a dose of 50 units of insulin, more than half the intended dose of 20 units. Consequences of such a dosage errror are potentially serious. The need for using only the U-40 syringe with U-40 insulin and the U-100 syringe with U-100 insulin is obvious. Obvious as well is the point that uniformity of concentration will greatly reduce the possibility of these large dosage errors.

Other recent changes in insulin are worthy of note.

In 1980, drug companies introduced what has been called "the new insulin." Processed beef or pork insulin (as is the "old insulin"), this new highly purified insulin contains significantly fewer impurities, considered by many physicians to cause side effects in the diabetic, including allergic reactions—a hive-like rash at the injection site; insulin atropy—loss of fat at areas of injection resulting in indentations or hollows; and immunologic insulin resistances—a rare condition almost always due to insulin antibodies. It is hoped that the use of purer insulin will contribute to decreasing these specific complications and to decreasing the incidence of diseases of the eye and kidneys which people with diabetes can develop. It is hoped that a similar contribution will be made by a synthesized insulin with an amino acid chain identical to that of human insulin; it is still in research.

These potential benefits of the "new insulin" stem partly from the fact that highly purified insulin is absorbed more rapidly and in some cases more thoroughly. The new insulins can thus prove more effective in lowering blood glucose levels; one result of using these products can be a decrease in the insulin dose required for glycemic control. But there are also potential hazards. It should be noted that any dosage error on the side of an unintended increase could have more pronounced capacity to send blood sugar levels too low, since both the more purified insulins and U-100 insulin are in effect stronger. For these insulins the exactness of measurement is at least somewhat critical. This caution is offered to point out the need for the diabetic with vision loss to have accurate devices and reliable techniques for measuring the insulin dose.

The availability of a new insulin product with the trade name Mixtard has been reported recently; it is on the shelf in larger, urban pharmacies. The insulin is composed of a stable mixture of 30% rapid-acting insulin and 70% intermediate-acting insulin. This premixed combination has potential use for those whose daily insulin injection consists of a so-called mixed dose. (Refer to "Diabetes: Some Physiological Considerations for the Blind Person," page 5.) Since measuring a mixed dose is more complicated than drawing up a single insulin, and since the procedure is further complicated by vision loss, it is possible that this product could prove useful. However, there have been cautionary comments by health professionals, who point out that this product would not permit the effects of the insulin dose to be monitored in respect of its specific components nor to be adjusted specifically for any changes in health or exercise. Yet those who believe they might benefit from this product should consult their physician. (The product is distributed by Nordisk USA; 7315 Wisconsin Avenue, Suite 851-W; Bethesda, MD 20014.)

Of course, for any contemplated change in insulin, the physician should be consulted. Insulin may be purchased from the pharmacy without a prescription; however, the basic form and daily dose(s) of insulin are originally determined and thereafter monitored by the physician.

In contrast to insulin, which is a nonprescription drug, the other basic equipment of insulin administration, insulin syringes, must be prescribed by the physician. The prescription specifies the type of insulin syringe which the person may purchase at the pharmacy. Generally, the insulin syringe consists of a sharp, hollow needle, through which insulin is both withdrawn from the vial to fill the syringe barrel and then injected into the body; the barrel, marked and calibrated for units of insulin; the plunger, which ends in a disk. The disk at the end of the plunger becomes an important component in measuring insulin without sight; it is referred to in Fig. 2 (and throughout this issue) as the plunger base.

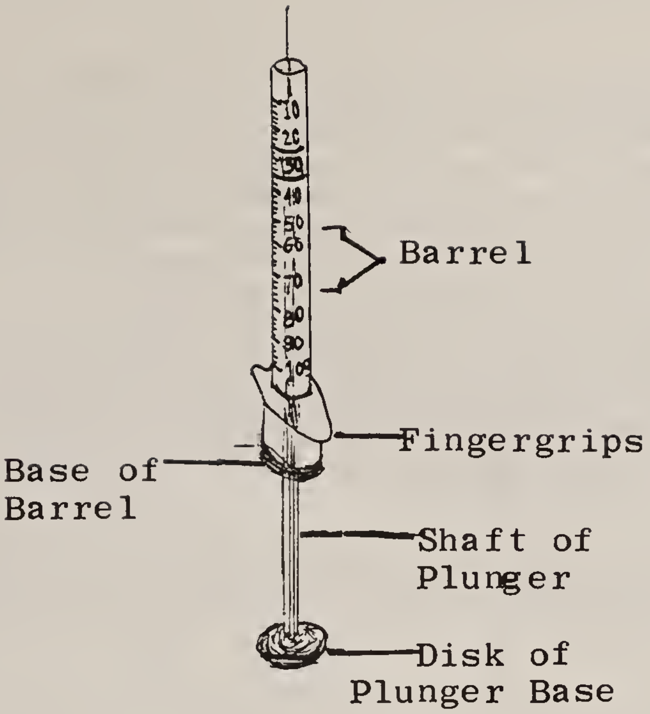


Figure 2

Before the introduction of plastic, disposable syringes, the basic device of insulin administration was the insulin syringe made of glass. But the glass syringes have several disadvantages. In glass syringes with removable needles, the hub, which holds the needle, creates so-called "dead-space"; here, up to 10 units of insulin may be hidden so that use of such syringes can result in dosage error. Other disadvantages include possible breakage, required sterilization with each use, and the eventual wearing away of the scale. Along with no possibility of dosage error from hidden insulin in the hub, plastic disposable syringes have other advantages: their fine-gauge needles are ultra-sharp for easy, comfortable insulin injection; they are pre-sterilized; and since they may be purchased in money-saving packs of quantities such as 10 or 100, they are economical. For these reasons, plastic disposable needles, for the majority of users, have replaced the glass insulin syringe.

Some gauges for measuring insulin without vision are designed for use with only certain brands and sizes of syringes. Thus it could be useful to know that for U-100 insulin there are two sizes of plastic disposable U-100 syringes and two sizes of reusable glass syringes. The two major manufacturers of insulin syringes, Becton-Dickinson and Monoject, each market a 1-cc disposable syringe and a .50-cc disposable plastic syringe; these syringes and their use with gauges for insulin measurement without vision are discussed in detail in "Measurement and Injection of Insulin by Blind or Visually Impaired Diabetics." Glass syringes also come in long and low dose sizes: 1-cc and .35-cc reusable syringes.

A final, useful product innovation requires mention: individually packaged alcohol wipes, for sterilizing the injection site, can replace the less convenient bottle of alcohol accompanied by cotton balls. In the East, Becton-Dickinson is a popular brand. Boxes contain 100 prepackaged alcohol wipes; price per box is currently less than $2.50.

This cursory description of the basic equipment used in insulin injection—forms of insulin and syringes—can, it is hoped, serve as background for the more particular explanations of "Devices for Insulin Administration with Vision Loss."

Insulin Gauges: Two Views

The two articles following present opposing perspectives on the evaluation and selection of insulin gauges. "Measuring and Injecting Insulin: Equipment and Techniques for Use by Blind or Visually Impaired Diabetics," by Joyce Schulz, R.N., advocates the exclusive use of the Insulgage, which is commercially manufactured; the article discusses reasons for choosing this device over all others. The article not only details the advantages of the Insulgage, it outlines the disadvantages of homemade devices.

The second article, "Modifications on Insulin Techniques for the Visually Impaired or Blind Diabetic," by Alice Raftary, M.Ed., develops the argument on behalf of the homemade insulin gauge. In addition, instructions are provided for fabricating one from common, household materials, and suggestions for teaching the use of any device are given.

Though the two articles are opposed, both present equally valuable information, information which, we feel, can be useful regardless of one's agreement or lack of agreement with the overall point of view of either article. Our intention is *not* to encourage the reader to choose one approach over another. Rather, we juxtapose the articles in hope that their strong contrast will serve to highlight the kind and range of criteria used in evaluating and selecting insulin gauges for individual use.

Measuring and Injecting Insulin: Equipment and Techniques for Use by Blind or Visually Impaired Diabetics

by

Joyce Schulz, R.N.

Technique for Labeling Insulin

With vision loss, locating and identifying vials become problems for the diabetic; knowing the amount of insulin contained in the vial as successive doses are withdrawn becomes equally difficult.

A system for labeling insulin vials is needed if the individual is taking a mixed dose of insulin, i.e., a short-acting insulin such as Regular or Semi-Lente. The simplest and easiest way of identifying the specific type of insulin is to stretch a rubber band around the longer-lasting vial. Another method used by some is to braille an R on tape and tape it to the Regular insulin vial. A variety of methods of marking can be used; but whatever method is chosen, it should make sense to the person and should be consistent. For instance, the longer-lasting insulin should not be labeled one time, then the shorter-acting insulin the next time.

To determine when an insulin vial is empty, the visually impaired diabetic must first of all determine the number of safe doses available in a vial and then have a system for keeping a record of the number of doses injected. A standard vial has 10 cc of insulin solution—whatever the type, strength, or brand. If U-100 insulin is being used, this would therefore equal 1000 units of insulin. For safety's sake, it is best to allow approximately 60 units of insulin to remain in the vial or 0.6 cc of solution. This will insure that the tip of the needle will always be in some solution. Without the amount of remaining insulin solution, the tip of the needle can protrude into air within the vial when it is inverted for withdrawing the insulin. The individual should therefore assume that a new vial of U-100 insulin has only 9.4 cc of safely usable insulin or 940 units. To determine the number of safe doses in the vial, the person must divide 940 by his dosage. For example, if a person's dose is 30 units, he or she can count on 31 safe doses since 31 is the result of dividing 940 units by 30—the number of units of each individual dose. When the number of safe doses has been withdrawn, the vial can be discarded or set aside until such time as a sighted person is available to withdraw the remaining insulin and insert it into a new vial.

A system to record accurately the number of doses administered is also a necessity. The particular system used is not as important in itself as the necessity that whatever system is used make sense to the person. One system is to count out the number of syringes equal to the number of safe doses in the vial. When the syringes are used up, the vial of insulin would also be finished. Small-sized counters are another system that some people find convenient. For example, a number of marbles, buttons, or toothpicks equal to the number of doses can be placed in a container; when each dose is administered, one object is taken from the container so that the empty container will signify that all safe doses have been used. Likewise, straight pins or safety pins in a number equal to the safe doses may be first stuck into a strip of cloth and then removed, one for each dose administered. Or pills or vitamins can be counted out, one for each dose, and swallowed before each shot; for those who take these medications daily, this system works well. Some visually impaired and blind diabetics prefer to keep a daily written or braille record of their insulin status and find this means most accurate.

Sterilizing Equipment and Inserting Needle into Vial

The widespread use of disposable needles and syringes has done away with the need for sterilizing equipment and such techniques as soaking syringes in alcohol and boiling needles. Yet for the visually impaired diabetic, inserting the needle directly into the insulin vial rubber stopper without contaminating the needle remains a problem of insulin administration. Contamination usually occurs by hitting the metal ring surrounding the rubber stopper with the needle. For many years a metal funnel-shaped needle guide was the only device available to help direct the needle into the rubber stopper. However, many people can still encounter problems with the needle hitting the side of the needle guide; if the needle guide is not itself sterile, the needle can become contaminated.

The Holdease Needle Guide and Syringe/Vial Holder, manufactured by Meditec, Inc., is a device available for solving this problem. The insulin vial snaps in one end, and the insulin syringe in the other so that the syringe needle slides directly into the insulin vial through the rubber stopper. There is no other material in its path to cause contamination.

Drawing and Measuring Insulin

Over the past several years a variety of devices to assist in self-measurement of insulin has been marketed; these devices vary with respect to safety and accuracy. Before determining which aid to select, some consideration needs to be given to the suitability of using disposable insulin syringes with any kind of volume regulator or precalibrated loading device.

There are various brands of disposable syringes—the three major brands being B-D, Monoject, and Jelco. Each of these manufacturers makes insulin syringes in several types—long, short, attached needle, lo-dose, etc. Each brand/type is different in its exact shape and dimensions.

During production the syringe manufacturers have careful control only over certain syringe dimensions such as the barrel of the syringe. A consistent dimension to each barrel of the syringe is necessary for accuracy when it is filled visually in the traditional method. Other parts of the syringe, specifically the plunger, play no part in the accuracy of the dosage measured and withdrawn using sight. These are of no concern to the manufacturers and are not necessarily checked. However, when a volume regulator such as Dos-Aid or pre-calibrated loading device such as the Insulgage loading gauge is used to measure insulin, the length of the plunger becomes equally important for an accurate dosage. It should be understood that only those brand/types of disposable syringes whose production characteristics are such that maximum variations of those parts affecting accuracy are sufficiently small should be selected for use with pre-calibrated or volume-regulating devices.

According to information from the manufacturer, the Monoject long 501 syringe is definitely not suitable and should not be used with any type of device.

Varying dimensions for the syringe plungers of different manufacturers can also make for hazards with homemade gadgets and devices commercially available. One of the generally unrecognized hazards with homemade gadgets and many of the volume regulators on the market is the capability of using various disposable syringes in the same device. Medication errors can result if the regulator has been pre-set or pre-cut for one brand/type of syringe and another brand/type of syringe is used. This can happen frequently because of special sales on syringes. The person can change his or her brand of syringe for economic reasons alone without foreseeing other consequences. Unless the person has been instructed and cautioned about the variances in brand/types of syringes, he or she may unknowingly measure up an amount of insulin with a device that has been pre-set to measure the specific dosage with another brand/type of syringe.

When selecting a particular device to aid in self-measurement of insulin, the essential aspects to consider are:

i. Is it safe? Is it possible to interchange various brand/types of syringes in it?

ii. Is it accurate?

iii. Can it be read by the visually impaired or blind diabetic so that he/she is not tied in to a sighted person for pre-setting the device each time his/her dosage is altered?

iv. Can a mixed dose be safely and accurately measured?

v. Is it simple and compact?

The one device on the market at the present time that meets all these needs is the Insulgage loading gauge manufactured by Meditec, Inc., Englewood, Colorado. My experience suggests that the Insulgage loading gauge in combination with the Holdease Needle Guide and Syringe/Vial Holder provides the visually impaired or blind diabetic with a safe, accurate means of measuring his or her insulin.

When actually drawing and measuring insulin, a concern many visually impaired diabetics and some professionals have is the possibility of drawing and injecting a large amount of air instead of insulin. Consistent use of proper techniques for filling the syringes assures safety in this area. There is also less chance of large bubbles being drawn up by using disposable syringes with attached needles. This is because of reduction of dead air since the hub of the needle has been eliminated. Reassurance should also be given that a large air bubble injected sub-cutaneously will not cause any damage, the only concern being that a large bubble of air will replace units of insulin, producing a medication error. A small pinpoint bubble of air is of no concern.

Specific instructions for drawing and measuring insulin with use of the Insulgage loading gauge and Holdease are as follows:

Dose of Single Insulin

(1) Rotate insulin vial between palms of hands to mix insulin.

(2) Wipe rubber stopper of insulin vial with alcohol wipe.

(3) Insert vial into Holdease—snap vial into large opening and slide inward until metal cap is against center divider.

(4) Insert syringe in Holdease—grip syringe near needle end, twist off needle guard and press syringe into clip through top opening.

(5) Pressurize vial—to correctly pressurize vial an amount of air equal to the insulin dose needs to be injected into the vial before solution is withdrawn. To achieve this, hold the gauge so that the slotted end is down. Place the slot in the gauge over the head of the plunger. Pull down with the gauge to withdraw the plunger, while pressing it lightly against the syringe. Remove gauge. Slide syringe lightly toward vial until stopped. Position holder with vial down and insert air into vial.

(6) Fill syringe—turn holder to upright position with vial on top. Grip syringe any comfortable way and pull plunger back about one finger's width—then push insulin back into vial. Repeat this procedure two more times—this is done to clear bubbles. With plunger pushed all the way in again, place the slot in the gauge over the head of the plunger. Pull down with the gauge to withdraw the plunger while pressing it lightly against the syringe. Pull the plunger out until the gauge fits between the plunger head and the end of the syringe. You can feel the gauge slipping in to fit over the disk plunger base. Then pull the plunger out a bit more—about 2 or 3 units. Now push the plunger in with the gauge as far as it will go. Note: In this final correctly loaded position, the disk of the plunger base should be firmly against the back of the slot in the gauge.

(7) Slip the gauge off the syringe. Slide syringe in clip until needle is completely out of vial. Turn needle end up to lift syringe out of clip.

Mixed Dose of Two Insulins

Two gauges are needed: see step (4) below.

(1) Pressurize vial of longer-acting type of insulin. Follow steps 1 through 3 for *Dose of Single Insulin* above; then slide needle out of vial without removing syringe. Slide vial of insulin out of holder.

(2) Fill syringe with shorter-acting type of insulin. Insert vial of shorter-acting insulin, pressurize it (step 5) and fill syringe (step 6).

(3) Change insulin vials in holder. Slide needle out of vial but leave syringe in clip. Slide out vial of short-acting insulin and insert (pressurized) vial of longer-acting insulin.

(4) Fill syringe with second type of insulin. Slide needle into vial and fill to prescribed total dosage (step 6). Note: The size of Insulgage used for the longer-acting insulin should be equal to the total insulin dosage since it will be added to the short-acting insulin already in the syringe, e.g., 4 units Regular insulin plus 16 units NPH insulin = 4 unit Regular gauge plus 20 unit gauge for NPH insulin.

(5) Remove syringe.

Injecting the Insulin

Insulin injection techniques are the same for the visually impaired diabetic as they are for the sighted diabetic with two exceptions. When injecting insulin, the person should stabilize the hand holding the syringe by placing the little finger against the skin as a point of reference and inserting the needle at the skin surface. This differs from the sighted technique of inserting the needle with a jab like throwing a dart.

After inserting the needle it is not necessary to pull back on the plunger to check for blood. Reassurance may be needed that this in no way endangers the person. This may be a step that the person has previously been taught is essential. When using proper technique and insulin injection sites, the probability of injecting into a blood vessel is remote. If this should occur, the only result would be a quicker absorption of the insulin.

Injection Technique:

(1) Wipe off the injection site with alcohol wipe.

(2) Pinch up the area where the needle will be inserted between thumb and fingers of free hand. Pinching up the area will pull the fat away from the muscle and the injection will then be into the fat. To pinch up the area on the arm, press the back of the upper arm against a chair back or corner of wall. Roll the arm down.

(3) Insert the needle as instructed above.

(4) The skin may also be spread between the fingers and needle inserted straight up and down in areas where there is more fat.

(5) Let go of the area and push in plunger.

(6) Place the alcohol wipe over the needle and pull needle out. Press wipe over the area for a few seconds.

Locating and Rotating Sites for Injection

Insulin may be injected in any area that has a thick layer of fat and is free from large blood vessels and nerve. Areas that may be safely used are the upper arms, thighs, buttocks, and abdomen. To locate the areas that are safe for injection of insulin, the following procedures may be used by the visually impaired diabetic.

To locate the injection site on the upper arm, place the heel of the right hand where the left arm joins the shoulder. With the right hand thus anchored, extend the middle finger to draw an imaginary line across the top of the upper arm. Then place the right hand, heel down, on the left elbow, extend the middle finger, and draw an imaginary line across the left upper arm with the right middle finger. The middle and outer area of the upper arm between these two imaginary lines may serve as an injection site. To use the right upper arm, reverse left and right in the foregoing instructions.

To locate the injection site on the thigh, place the left hand, heel down, on the left hip bone and draw a line below the point where the middle finger rests. Then place the left hand at the bottom of the thigh with the middle finger just touching the knee cap; use the fingers of the right hand to draw a line across the thigh where the heel of the left hand rests. Use the middle and outer area of the thigh between the two imaginary lines for insulin injection. To use the right thigh, reverse left and right in the foregoing instructions.

To locate injection sites on the abdomen, place the heels of the hands on the lower ribs and draw a line using the middle fingers. Place hands on hip bones and draw a similar line. Use the area between these two imaginary lines as far as you can pinch up fat. Do not use the belt line or a one-inch area around the navel. If there is enough fat to pinch up, the buttocks may also be used.

It is important to rotate or alternate these injection sites from dose to dose, day to day. If one site is used repeatedly without days intervening between injections, then the fatty tissue will change in ways that can interfere with absorption of the insulin. On the other hand, if a completely unused site is suddenly used, then the insulin may be absorbed too well, too quickly, causing insulin reaction. Site rotation is important in the prevention of both these problems.

REFERENCES

Isenberg, Joel S. "Self-administration of Insulin by Visually Impaired Diabetics." Meditec, Inc., Englewood, Colorado.

Isenberg, J.S. "Disposable Insulin Syringes — Suitability for Use with the Insulgage Gages." Meditec, Inc., Englewood, Colorado.

Nursing Skillbook: "Managing Diabetics Properly," Intermed Communications, 1977.

Modifications on Insulin Techniques for the Visually Impaired or Blind Diabetic

by

Alice Raftary, M.Ed.

A simple, homemade volume regulator for measuring insulin can be constructed from a row of staples; for the diabetic who is suffering a visual loss, even temporarily, it can provide a means of coping with a lower level of acuity. The templet measurement technique ought to be introduced at the time of initial visual impairment, since the procedure is most easily learned when useable vision remains. Not only the measuring technique can be learned at this time, but also the method for constructing the templet. These techniques, once learned, become a part of motor memory and can be used in any case of vision impairment—even total blindness. The templet technique is thus to be preferred to the use of magnifiers because it can provide a permanent solution to the problem of accuracy in insulin draw.

Making the Templet

Simply and economically, a templet of refill staples and a soft adhesive tape (masking, mystic, surgical, etc.) can be made; made according to the following procedure, it will be accurate. Set the insulin dose on the syringe. Break off a length of staples slightly longer than the length of exposed plunger. Remove a few staples at a time, until the length of staples fits snugly between the exposed plunger end and the syringe barrel. Wrap the length of staples, including one of the angles, with tape to insure permanence and rigidity. Check the accuracy of the templet.

Advantages of the Staple Templet

The chief advantage of this homemade device is its ready availability. If there is a prescription change or a templet has been lost, a homemade templet can be made on the spot. This templet is easy to construct and the inexpensive materials are found in most homes and office settings. For example, if one needs a template made when in a motel, the length of staples and the few inches of tape would be freely provided by the desk clerk. On the other hand, the commercial aids are infrequently available at pharmacies and mail-orders may require 6-8 weeks for delivery. Although their ready availability, freedom from cost, and ease of assembly make staples the preferred material for a homemade templet, other materials, e.g. plastic or metal tubing, will also work.

Important Note

A new templet is necessary when there is a change in the amount or type of insulin prescribed; when there is a change in the manufacture or model of the syringe to be used by the patient; if it becomes raggedy after much use.

Disposable syringes should be used since the plunger of the plastic disposable syringe is easier to control.

Technique for Drawing Up Insulin

—Assemble all equipment on a small, shallow tray or box.

—Mix insulin by rolling the vial gently between the palms of the hands.

—Cleanse the vial cap with an alcohol swab. Return swab to tray.

—Uncover the needle. *After the needle is uncovered, the syringe does not leave the hands until it is ready for disposal.*

In the dominant hand, hold the syringe near the needle hub as a pencil. With the other hand, hold the insulin vial firmly upright on the table, thumb and forefinger at the neck of the vial.

As the needle is brought to rest across the vial top, the free fingers of the hand holding the syringe will help locate the vial and steady the hand.

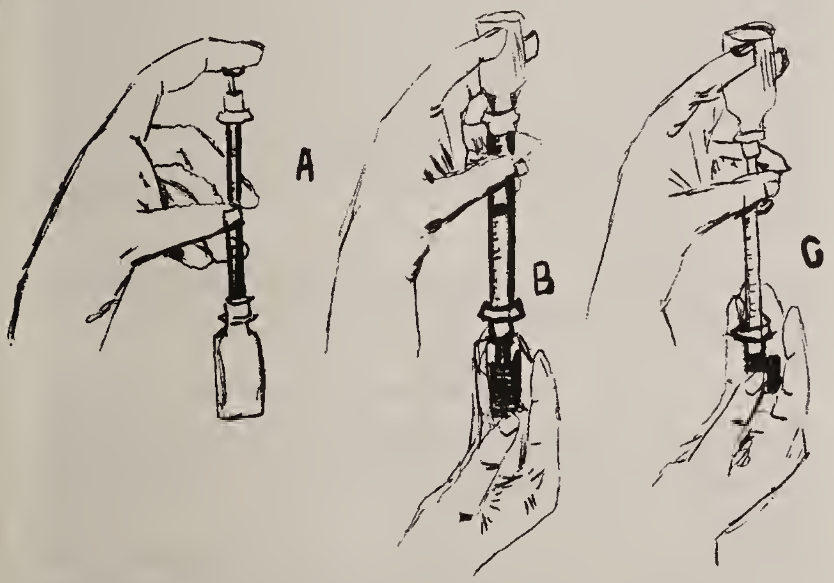
Draw the needle across the vial cap. There will be a small "click" as the tip comes off the metal ring onto the rubber. Rotate the syringe to the perpendicular and insert it into the vial. If the needle is not on the rubber, there will be resistance. Don't force it, as the needle will bend. Start over.

—*Draw air into the syringe to the amount of the insulin dose by placing the templet along the shaft of the plunger and seating it snugly. Remove the templet and return it to the tray for easy relocation.*

—*With the vial resting firmly upright on the table, insert the needle. Expel the air into the vial.*

—*Slowly invert the vial with syringe attached. Hold it in a vertical position in one hand, leaving the dominant hand free to manipulate the plunger. Keep the equipment in a vertical position until the insulin is fully drawn. (Figs. B and C)*

—*With the dominant hand, pull out the plunger approximately 1/4" farther than necessary to insert the templet. Position the templet along the plunger shaft. (Fig. B) Push the plunger up so that the templet is seated. The insulin in the syringe is the dosage prescribed. (Fig. C)*



Additional Procedures for Two Insulins in a Single Dose

—Make two templets. One templet should be made to measure units drawn first. The other templet is the length of the combined dose. Be sure the insulins can be differentiated tactually (e.g., a rubber band around one of the vials).

—Draw up air with the longer templet to the combined dose.

—Remove templet and insert needle in vial of insulin to be drawn second.

—Place the small templet along the shaft of the plunger, and expel air into the vial until the small templet is seated.

—Withdraw syringe with templet still in place.

—Insert needle into the vial of insulin to be drawn first.

—Remove templet and expel air.

—Draw up the first part of the dose, following the procedure described in the previous section.

—Remove the needle from the vial, keeping the templet in place. Return the vial to the tray.

—Keeping the templet in place, insert the needle into the second vial.

—Invert the vial, and remove the small templet, drawing up a few units.

—Set the longer templet with the end resting on the end of the plunger, and carefully pull out the plunger, steadying the templet with the thumb until the templet drops into place and is seated. (Fig. C) Do not expel any insulin back into the second vial.

—Withdraw the syringe from the vial with templet in place. If extra insulin was drawn, discard it by seating the templet.

—Remove the templet and proceed with injection.

Instructing the Blind Patient

CAUTION! This is not a complete insulin instruction. It is concerned with technique modification and presumes a considerable knowledge of diabetes and insulin management. Persons with a non-medical background should use this article with the consultation of an experienced nurse or clinician. Improper interpretation of insulin prescription can have serious consequences. It should be noted that insulin is a potentially lethal drug. In instructing the blind diabetic in the use of devices for nonvisual measurement of insulin, remember to consider his or her physical tolerance, mental alertness, etc.

ORGANIZE instructions and instructional materials thoroughly. Be consistent. Repeat instructions in the same terms and sequence. Be sure the patient understands the terminology you are using.

POSITION the patient. If the task to be learned is one he or she performed before, have the patient assume the familiar and comfortable position. If it is a new task, put the person in the posture best for him or her.

PROVIDE AMPLE TIME for the person to become familiar with the task. Have the person examine and manipulate thoroughly all materials and equipment used. Let the person observe and examine your demonstration tactually as you give verbal instruction.

INDIVIDUALIZE INSTRUCTION. If the person has had previous experience with the skill being taught, allow him or her to demonstrate present proficiency. Begin instruction at this level.

Experiment with possible adaptations and alternatives, e.g., other techniques of manipulation and/or use of assistive devices. Use short, frequent instruction periods. Do not rush instruction. Make sure that each step of the procedure is mastered before going on to the next step. Supervise the practice until you are reasonably sure that the patient will not be practicing an incorrect technique.

BE PRAGMATIC in your evaluation. Accomplishing the task is more important than the style of performance. Give plenty of positive reinforcement. (Nothing succeeds like success!) At the same time, be realistic and don't try to "con" the person.

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With the use of sight, the insulin dose is measured by reading the scale printed on the syringe barrel. The insulin vial is first pressurized so that the liquid will flow easily and smoothly when it is withdrawn into the syringe. To then withdraw the proper amount of insulin, the pressurized vial, with the syringe inserted, is inverted, the syringe plunger is pulled halfway down the syringe barrel, and a column of insulin half the length of the syringe is drawn up. To measure the exact amount for a particular dose, the plunger is then pushed in expelling excess insulin until the plunger head is observed to align with the scale marking for the desired dose.

Mechanical characteristics of the syringe itself, rather than the printed scale, can be used to accomplish the same procedure. The distance between the plunger base, pulled out from the barrel, and some fixed point on the barrel itself, for instance its base, will stay constant for any specific dose drawn. (Refer to Figure 2 on page 7.) Devices for nonvisual measurement of insulin all work according to this principle: that is, insulin gauges, including those volume regulators built into the syringe itself, control the distance between the base of the syringe barrel and the base of the plunger—they fix the distance to which the plunger can be pushed or pulled, or they tactually or aurally indicate it. The height of any given column of insulin drawn up in a specific number of units will always correspond to a fixed distance between the plunger base and syringe base of a particular syringe or of a syringe with the *exact* dimensions—thickness of plunger base, etc. As Joyce Schulz points out, it is thus crucial always to use the same brand and model of syringe with a particular preset insulin gauge and to use only those brands and models of syringes in which dimensions are consistent from syringe to syringe.

Devices called needle guides can be equally essential in nonvisual insulin administration. Needle guides, as the name suggests, aid in centering the hypodermic needle on the vial's rubber stopper. Some needle guides also hold the vial and keep it steady.

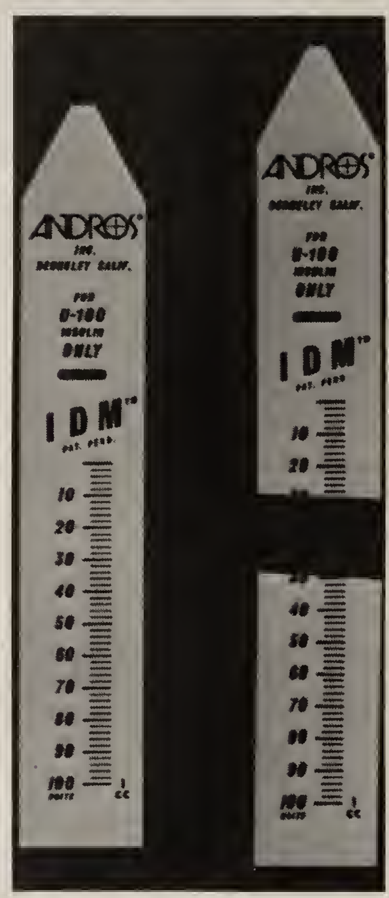
Magnifiers constitute another category of devices for insulin administration with vision loss. For some persons with remaining useable vision, hand or spectacle magnifiers can aid in both tasks—guiding the needle to the vial stopper and measuring the insulin dose in the syringe. While these magnifiers make all features of syringe and vial appear larger, magnifiers designed to attach to the syringe itself enlarge the lines and numbers of the unit scale only.

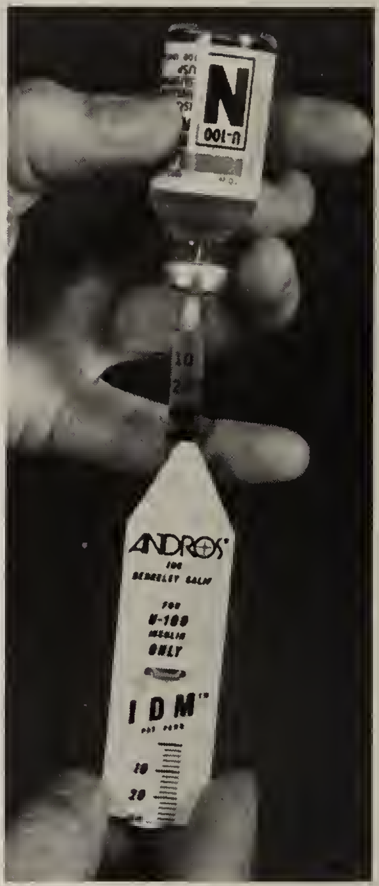
From our survey of rehabilitation and health professionals and of consumers, all of these devices would appear to have potential advantages and limitations. The appropriateness of any device ultimately depends on the particulars of a person's individual characteristics and circumstances of daily life. The following guide compiles descriptions of the devices with comments on their utility under various conditions.

For participating in the survey, we would like to thank in particular Ruth B. Carr, Richard M. Connors, Davide Marletta, Laura V. Marletta, Judith W. Oehler, Alice Raftary, Joyce Schultz, and Allene R. VanSon. We are also most grateful to Brian Collins of Toronto, Canada, for supplying not only valuable information but also some actual equipment purchased from the Canadian National Institute for the Blind. While some comments are not attributed to individuals, lengthier discussions bear the initials of their principal author.

Insulin Gauges

Andros IDM





Measures 1″ x 4″. Made of stiff but thin and flexible sheet plastic. Unit scale is printed the length of the gauge. Above unit scale is cut a slot for syringe's fingergrips. A nurse or physician is to cut the gauge at the unit line corresponding to the prescribed insulin dose. During use, the fingergrips of the syringe fit into the slot with the needle extending upward and over the gauge's arrow-shaped head. Then the plunger is pulled until the disk of the plunger base snaps past the edge of the gauge, already cut for the desired dose. The plunger is then pushed in until the disk is in contact with the edge of the gauge to set the dosage.

Essential features: For use with Becton-Dickinson's #8409 Plastipak U-100 disposable syringes *only*. Unit scale calibrated in 2-unit gradations.

Advantages: Scale is precisely calibrated and consistent for individual gauges. The slot fot syringe's fingergrips is precision cut to admit only the Becton-Dickinson #8409 Plastipak U-100 disposable syringe, for which the scale is calibrated—an effective safety precaution.

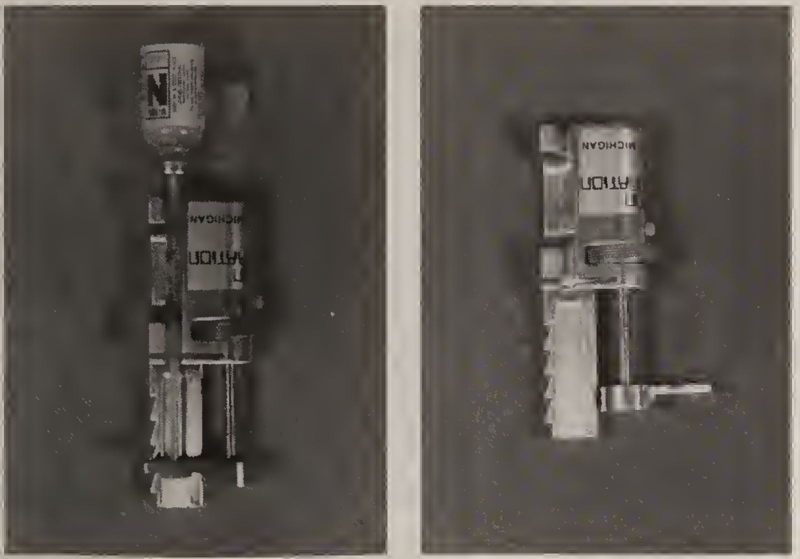
Disadvantages: Flimsy. Can be difficult to hold firmly while withdrawing plunger of syringe—also difficult to teach because there is no clear-cut step-by-step technique for solving this problem. (J.W.O.) Flexibility can cause dose to be off by several units if force is applied during measurement; ability to bend inspires mistrust. (B.C.) Can be quite difficult to cut evenly at proper unit line. Cannot be set by the visually impaired user. The 2-unit gradations of the scale make measuring odd numbered doses less accurate. Single IDM cannot be used to measure mixed doses or to change dose.

Solution: Several gauges may be ordered: one for intermediate acting insulin, one for combined dose of intermediate and regular insulin to accomplish mixed dosage. Others may be ordered and cut for predicted dose changes.

Independent Living Aids
11 Commercial Court
Plainview, NY 11803

Price: $3.50
Order No.: 074300

Cyberon Adjustable Gauging Device



Measures approximately 6″ x 2″. Prototype machined from metal alloy. Production models will probably be injection molded plastic. The central body of the device is basically rectangular with a "tongue" extending from body at lower left corner. A trough is machined on face along left edge above "tongue." This trough will accept the syringe barrel while a horizontal slot at base of trough will hold the syringe fingergrips.

During use, the syringe is held in trough by friction. The plunger extends from body of the gauge and down the "tongue." A threaded rod screws into base and through a thumbwheel fitted into body of gauge; at the base of this rod is a metal "flipper" that can be swiveled to hook over plunger shaft so that outside edge of flipper pushes against inside edge of the plunger base disk. Each full revolution of the thumbwheel moves the "flipper" a distance equivalent to one unit on the syringe. The thumbwheel is indexed so that it clicks each time a revolution is completed in the forward direction that increases dosage. In the reverse direction, no click is audible, but a resistance is felt when the revolution is completed. Notches cut into the left side of the "tongue" indicate tactually 10-unit increments as a guide to the dosage. The gauge may be preset before the needle is inserted into the vial; the plunger is pulled to draw up excess insulin, then pushed to expel excess back into vial until "flipper" stops movement at correct dose. Or the gauge may be set with the needle already inserted, a procedure which will pull out the plunger, filling the syringe gradually, one unit per turn of the thumbwheel. Because dosage setting is thus adjustable independently by user at time of use, device is suitable for measuring mixed doses of insulin. The physical design of the gauge allows the syringe to remain in the gauging unit while injection is administered.

A patent application has been filed on this device, and Cyberon Corporation is presently exploring a variety of methods for manufacturing, marketig, and/or licensing this device. (For further information, contact Eliot Friedman, President of Cyberon Corporation, at the address below.)

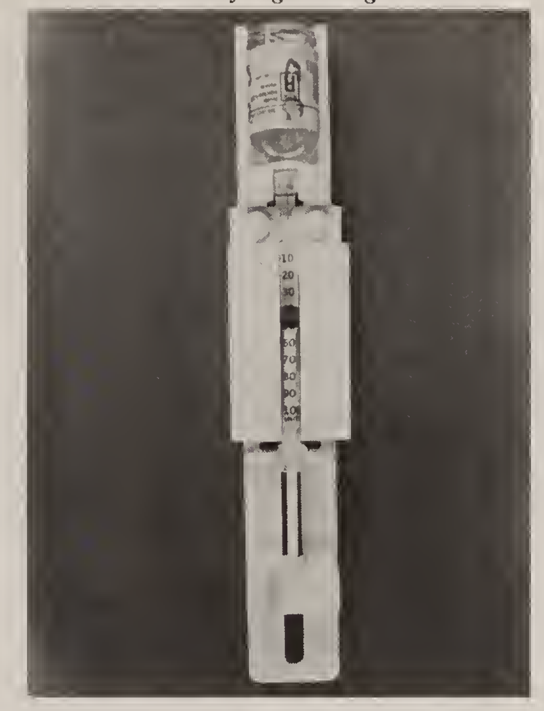
Essential features: Prototype has been machined in two models: one to fit B-D Lo-Dose U-100 syringe, one to fit Monoject Lo-Dose U-100 syringe. In production, one model may be developed to accept either brand of disposable 1/2 cc syringe.

Advantages: Accurate. Beautifully machined. Ingenious and functional design.

Disadvantages: Setting the device can seem to require a good deal of time—30 seconds to several minutes per injection. During this time, holding insulin vial steady can be a problem. Count of clicks can be lost without high degree of concentration, good hearing, tactual sensitivity.

Cyberon Corporation
1175 Wendy Road
Ann Arbor, MI 48103
(313) 994-0326

Dos-Aid Syringe Filling Device



Measures 7″ x 1 1/2″. Made of rigid plastic. The two-inch cradle at top holds insulin vial; attached by screws it is allowed to slide on main body of guide. The vial cradle is moved up or down to lengthen or shorten distance between insulin vial and syringe to adjust to specific syringe type. The middle consists of two blocks, side by side, with a vertical gap between them to hold the syringe barrel. Amount of separation adjusts to fit girth of specific syringe type. At the base of these blocks is a slot for the syringe's fingergrips. The bottom third of the device holds a block which can slide forward or back to set the guide for the desired insulin dose. To set, the syringe barrel rests in the syringe trough between two middle blocks with fingergrips in the fingergrip slots. The plunger is withdrawn to desired dose and the plunger stop (block) is pushed to rest against the disk of the plunger base. The screws are tightened. Now the block controls the distance to which the syringe plunger can be pulled and thus determines the insulin dose which can be drawn up. To be set by a health professional.

Essential features: Designed to measure single dose only. Designed for use with 1 cc syringes only; cannot be used with lo-dose syringes since even the closest position of vial cradle is still too distant for any lo-dose syringe to reach.

Advantages: Convenience of having vial holder, needle guide, and insulin gauge in one unit. Easy to locate and handle because of large size. Useful for limited dexterity such as that caused by one-handedness or severe neuropathy. (R.B.C.)

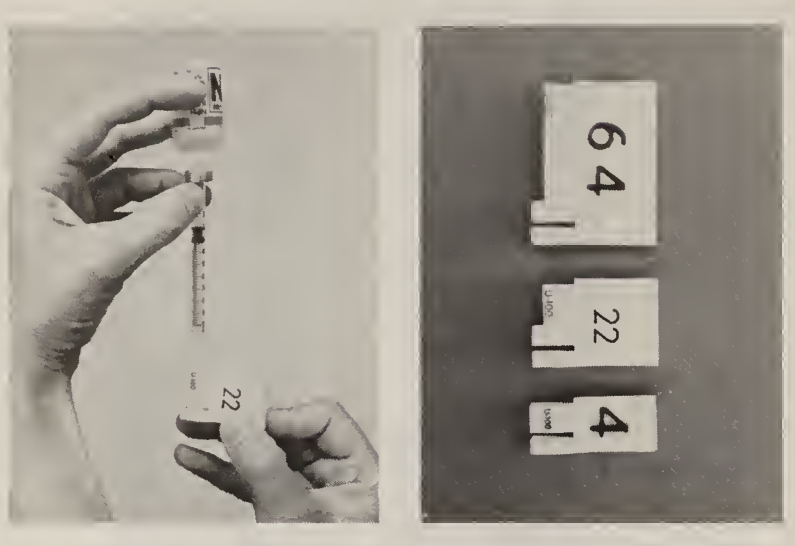
Disadvantages: Bulk makes it cumbersome to carry around daily. Screws can loosen and settings can change without user's awareness. Must be preset by sighted help. The use of various brands/types of syringes is not absolutely prevented. The slot for syringe fingergrips is wide enough to accommodate any brand or type of syringe, potentially causing dosage error. Dosage error can also result from ability of syringe to jostle in trough. (J.N.S.)

Solutions: Engineers at the American Foundation for the Blind are presently working on an improved Dos-Aid. Now in prototype, the device would have the capability of measuring a mixed dose, indicating automatically when the insulin vial is empty, and permitting the insulin dose setting to be varied at will.

American Foundation for the Blind
Consumer Products Department
15 West 16th Street
New York, NY 10011

Price: $17.95
Order No.: NES-563

Centre Louis-Hebert Inc.
1270 Chemin Ste-Foy (4e Etage)
Quebec - G1S 2M4
Tel.: (418) 687-3470



Insulgage Loading Gauge

Measures 1 5/8″ in width. A 1/4″ thick rectangle, the height varies according to insulin dose for which the gauge is calibrated. High quality, durableplastic. Individual gauges are cut to length by manufacturer; the length corresponds to distance between the base of syringe plunger and the base of syringe barrel for a specific insulin dose drawn by a Becton-Dickinson Plastipak #8409 Long U 100 Syringe only. Gauges are produced in sizes ranging from 4 units U-100 insulin to 85 units; within this range, sizes are available only for even numbered units or for numbers of units which are multiples of 5. For mixed doses and anticipated dose changes, a variety of gauges may be ordered.

During use, the shaft of the syringe plunger fits into the hollowed-out vertical edge, and the disk of the plunger base slips into the horizontal notch. (Refer to "Measuring and Injecting Insulin" on page of this issue.). Body of gauge contoured for firm grasp. Face of gauge labeled with insulin dose, choice of media: black large print numerals; 1/2″ tall, raised plastic numbers; or braille. Both braille and raised numbers are also available.

Essential features: For use with a Becton-Dickinson Plastipak #8409 Long U-100 syringe only.

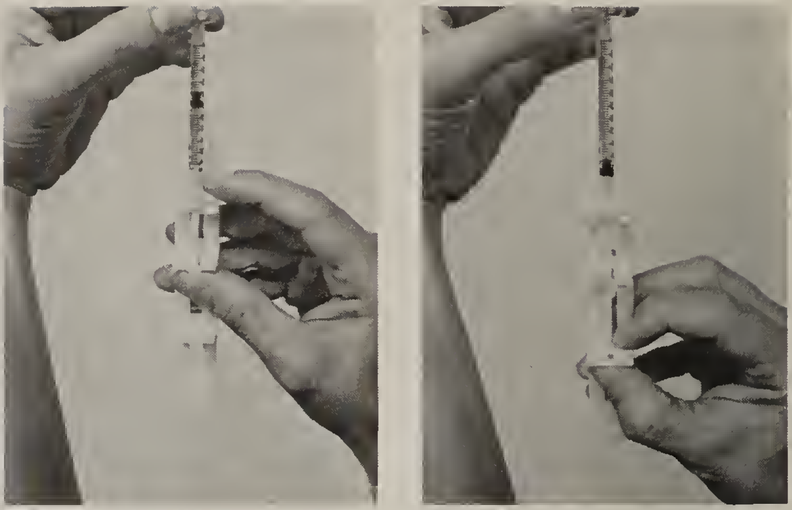
Advantages: Normal hand-motor control is adequate dexterity for use; neuropathy does not significantly interfere with technique. Mixed doses can be measured with use of 2 gauges—one for short-acting insulin and one for combined dose of short-acting insulin and intermediate-acting insulin. Simplicity and sturdiness of device makes practical the techniques of injecting regular insulin before each meal for tight control. (D.M.) (J.W.O.)

Disadvantages: Some consumers report long waits for order to be filled. Device has a 2-unit play in the notch where plunger base rests, which can cause a 2-unit dosage error if care is not taken to perform technique of measurement consistently.

Solutions: Dosage error may be avoided by consistently pulling plunger out farther than necessary, inserting plunger base into notch, plunger shaft into hollowed edge, and pushing in until gauge prevents plunger from further movement. Plunger base will always be resting against back of the notch, with base of syringe barrel fixed against top edge of gauge. Distance between plunger base and barrel base will always be consistent; dose will be constant. (D.M.)

Meditec, Inc.
9485 East Orchard Drive
Englewood, CO 80111
(303) 771-4863

Price: large print label—$3.50
braille label— 4.00
raised numbers— 4.50
To order: obtain order for
from Meditec



Morris Watts Insulin Gauge

Measures 5 1/2″ x 3/4″ approximately. Made of durable plastic. Consists of a long, narrow foundation into which are molded two sturdy raised clips and on which are mounted two adjustable blocks. The first set of clips, prongs, hold the syringe barrel; an inch below, a second set, a raised horizontal channel, holds the fingergrips of the syringe. On the bottom two-thirds of the foundation, the two stops are attached by screws to a vertical slide which allows them to move forward or back. The screws tighten the stops in the desired position to regulate the distance to which the syringe plunger may be either pushed or pulled. The plunger can move only between these two blocks. They allow a mixed dose to be drawn up.

During use, the syringe barrel and fingergrips are fixed in their respective clips with needle extending over the top edge of guide. The first "adjusta-stop" is shaped like the letter "H". While the narrow space between the uprights allows the plunger shaft to rest on the crossbar, it also catches and holds the disk of the plunger base. It is set at a distance corresponding to the dose of the first insulin and prevents the plunger from being pulled back farther than the distance needed to draw up prescribed dose of second insulin.

To draw up a mixed dose, a disposable syringe still covered by its needle guard is placed in the guide by slipping the syringe plunger into the first stop at the space between uprights of "H" and holding disk of plunger base against first stop while pulling syringe barrel forward with other hand until syringe fingergrips come to rest properly in the riase horizontal channel; then the barrel's midsection snaps into top prongs. Finally, the plunger is withdrawn until the disk of its base rests against second stop. The needle guard is removed, and the needle is inserted into first insulin vial. Plunger is pushed all the way to first stop to inject air and pressurize vial; because its motion is arrested by first stop, syringe will still contain a column of air equal to first insulin dose. Ideally, the plunger is then withdrawn quickly and smoothly so that insulin from the vial rushes into syringe and through air already contained. The first insulin thus fills barrel from bottom of space upwards in an amount greater than its prescribed dosage. The manufacturer recommends flicking the syringe barrel with the fingers at this point in order to disperse any air bubbles which might cause dosage error. Then excess insulin and the column of air on top are expelled into vial of first insulin by pushing plunger in until first stop again arrests its movement. With plunger thus pushed all the way to first "adjusta-stop," correct dose of first insulin is measured.

To measure second insulin, syringe is removed from first vial, and needle is inserted into vial of second insulin. Plunger is pulled to second (bottom) "adjusta-stop" to withdraw prescribed dose of second insulin for mixed dose. The manufacturer recommends that either a physician or nurse set this device and demonstrate its proper use; practice should proceed under medical supervision.

Essential features: For either B-D Plastipak Lo-Dose Syringe or Monoject disposable syringe in either 1cc (full size) or 1/2cc (lo dose).

Advantages: Screws, washers, and plastic are of highest grade material so that the "adjusta-stops" are fixed tightly and reliably at desired settings. Lightweight and compact. Durable. Fingergrip channel is designed to hold B-D Lo-Dose Syringe securely. With use of magnifying glass, consumer with low vision can set the device independently. (B.C.)

Disadvantages: Cannot be adjusted at will without vision. No provision for using device to measure and inject pressurizing air into second insulin. Monoject 1/2cc syringe fits less snugly into fingergrip channel allowing the possibility of some play and dosage error. Ability to use various brands and models of disposable syringes has potential for dosage error: once the device is set for one brand and type of syringe, it is accurate *only* for that brand and type, even while others will fit device. Large air bubbles replacing insulin and causing dosage error *can* occur if plunger is not withdrawn quickly and smoothly. As explained above, the first insulin must rush past a column of air already standing in the syringe. If the plunger is withdrawn too slowly, insulin does not rush in with sufficient force to flow under the air and displace it; rather, air is trapped at bottom of dosage column so that air bubbles form. In our limited experience and evaluation, the manufacturer's recommendation to snap barrel repeatedly does not always disperse bubbles so that insulin dose is corrected.

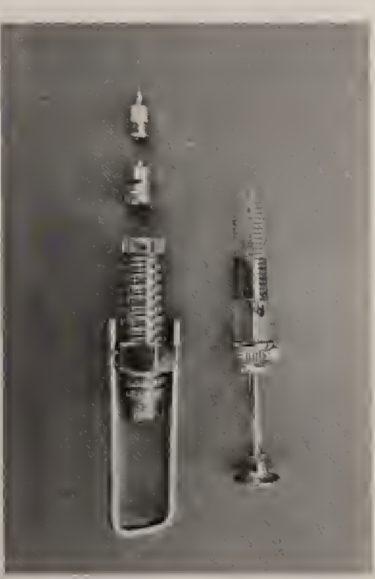
Solutions: To pressurize second insulin vial, an arbitrary amount of air may be injected with syringe before it is place in guide. To avoid interchanging brands and models of syringes and to avoid play noticeable with Monoject 1/2cc syringes, consistently use B-D Plastic Lo-Dose Syringes. To avoid air bubbles, practice proper technique under medical supervision until perfected or have syringe checked by sighted help.

Canadian National Institute for the Blind
350 East 36th Avenue
Vancouver, B.C.
Canada V5W 1C6

Homecraft Department
Canadian National Institute for the Blind
1929 Bayview Avenue
Toronto, Ontario M4G 3E8
Canada

Price: $3.25
(Canadian currency)

AFB Insulin Syringe



Measures 5 1/2″ in length with plunger fully extended; barrel is 1/2″ in diameter. Barrel consists of brass nickle-plated casing which encloses a 2 cc glass syringe barrel. Plunger is stainless steel. The principal fitting is a U-shaped brace or plunger stop. Also brass nickle-plated, the ends of the brace pivot on a nut which moves up or down the barrel of the casing by rotating along the screw-thread machined the entire length of the casing. When the brace is in line with the metal casing, it serves to catch the plunger base in the notched U of the brace, fixing the distance between plunger base and syringe base. This distance corresponds to a particular dosage of the interior glass syringe. This distance, and thus the dosage, is monitored and set by rotating the nut to which the brace is welded. Beginning with nut in position closest to needle end, each quarter rotation on screw-threaded casing produces an audible click; each click indicates an increase of 1/20 milliliter of liquid. The syringe may be used to measure any strength insulin—U-40, U-80, or U-100. The number of clicks to turn the nut must be determined mathematically for a particular insulin strength. For example, to determine number of clicks for a dose of 20 units of U-100 insulin, consider the following givens and reltionships: each click indicates 1/20 milliliter of liquid; each milliliter of U-100 insulin contains 100 units of insulin. Thus each click withdraws 5 units of insulin because 1/20 (number of milliliters per click) x 100 (number of total insulin units per milliliter of liquid in U-100 insulin) = 5 (units of U-100 insulin per click). Then 4 clicks would draw up the desired dose of 20 units (4 clicks x 5 units per click = 20 units of U-100 insulin). By turning nut so that 2 clicks are heard, the brace is in place to withdraw plunger for filling syringe with 10 units U-100 insulin; 3 clicks for 15 units; and so on.

With the U-shaped plunger stop so set for the correct dose, the plunger is first withdrawn fully. Then the U-shaped stop is pivoted up to the position which aligns with syringe barrel and plunger. Plunger is next pushed in until the disk of the plunger base is caught and halted by the notch in the bottom of the U-shaped stop: this procedure measures air to pressurize insulin vial. U-shaped plunger stop is pivoted down at a right angle with device barrel, to make way for the plunger to be pushed in. Thus air is injected into vial, vial with syringe still inserted is inverted, and plunger is then withdrawn to furthest position drawing up a quantity of insulin greater than required dose. To measure correct dose, U-shaped stop pivots once more to align with device barrel, and plunger is pushed in until disk of base is halted by preset plunger stop, as in measurement of pressurizing air. This maneuver expels excess insulin back into vial, and correct dose remains in syringe for injection. Entire unit is used.

Essential features: Requires addition of stainless steel needle or disposable microfine needles. Requires sterilization. Unit consists of seven separate parts: metal barrel casing; brace on nut; glass interior syringe barrel; needle connector; plunger shaft; plunger head (which can unscrew from plunger shaft); nut for base of metal barrel.

Advantages: High quality, durable materials. Precision-made. Independently adjustable. Can be used to change dose at will without sighted help. Could be used for multiple daily injections of regular (rapid-acting) insulin for tight control.

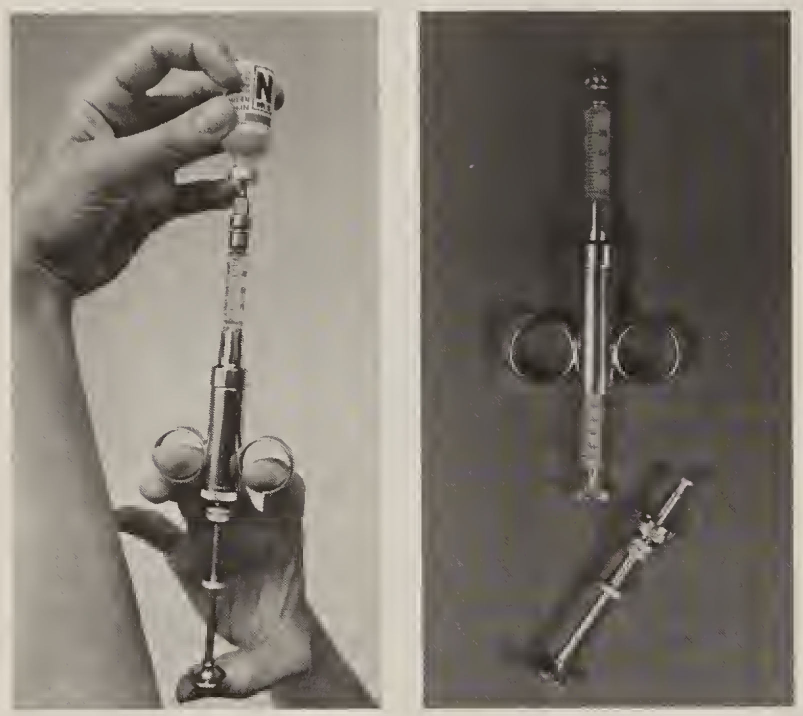
Disadvantages: High level of concentration and hearing and/or tactual sensitivity required to hear clicks or feel resistance which indicates dosage increments as stop is rotated on barrel. Because of number of separate parts, reassembly after sterilization can be difficult, especially with vision loss. U-100 insulin can be measured in 5-unit increments only. U-40 insulin can be measured in 2-unit increments (since each click = 1/20 milliliter, and 1/20 milliliter of U-40 = 2 units of insulin); however, U-40 insulin is being phased out. Math to determine number of clicks for desired dose can frustrate some persons. Difficulties can discourage reliance on device and thus independence. (J.W.O.)

American Foundation for the Blind
Consumer Products Department
15 West 16th Street
New York, NY 10011

Price: $26.00
Order No.: MES 260

Boers & Co. B.V.
Postbus 67
3100 AB Schiedam
Rotterdam
The Netherlands

B-D Cornwall Syringe



Body of the principal mechanism measures approximately 3″ in length and 1/2″ in diameter. In its pronged opening, this metal cylinder holds a Becton-Dickinson glass 1 cc U-100 syringe, its barrel extending fully from the cylinder with the barrel base gripped firmly within the prongs. The cylinder itself contains the glass plunger which has been inserted through a metal spring. A metal plunger enters the base of the metal cylinder through a threaded metal regulating sleeve which screws into the base of the metal cylinder. Inside the metal cylinder, this threaded sleeve acts as a plunger stop; it fixes the distance to which the glass syringe plunger can be withdrawn and sets the prescribed dose of insulin. The more the metal sleeve is screwed into the base of the metal cylinder, the farther the glass plunger is set into the glass syringe barrel, and the smaller is the dose thus set. The two lock nuts at the top of the metal sleeve are to hold the setting tight. The metal plunger which slides through the sleeve also makes contact with the disk of the glass plunger inside the metal cylinder. With device held vertically and needle inserted into inverted vial, the function of the metal plunger is to push the glass plunger all the way into the glass syringe barrel, an action which expels air into the insulin vial and compresses spring around glass plunger. The metal plunger is then released, and this action allows the spring compressed around glass plunger to recoil and retract glass plunger but only to position of regulating sleeve, which acts as plunger stop. Thus the desired dose of insulin is withdrawn.

The two circular grips welded to the exterior of the cylinder enable the fingers to grasp the device firmly in order for the thumb to squeeze the plunger.

Essential features: Requires the addition of reusable stainless steel or disposable microfine hypodermic needles. Requires sterilization. When disassembled, consists of five separate components. Measures single dose only. To be set by health professional; can be ordered by doctor or nurse only.

Advantages: Can be set accurately (with the use of sight). Metal components are durable; glass syringe is replaceable. Withdraws proper dose smoothly and quickly.

Disadvantages: Must be set by sighted help. Without careful and consistent technique, lock nuts *can* unscrew and change setting (especially increase) during use or during disassembly sterilization and subsequent reassembly. (J.O.W.) (R.M.C.) Must be reset after each sterilization.

American Foundation for the Blind
Consumer Products Department
15 West 16th Street
New York, NY 10011

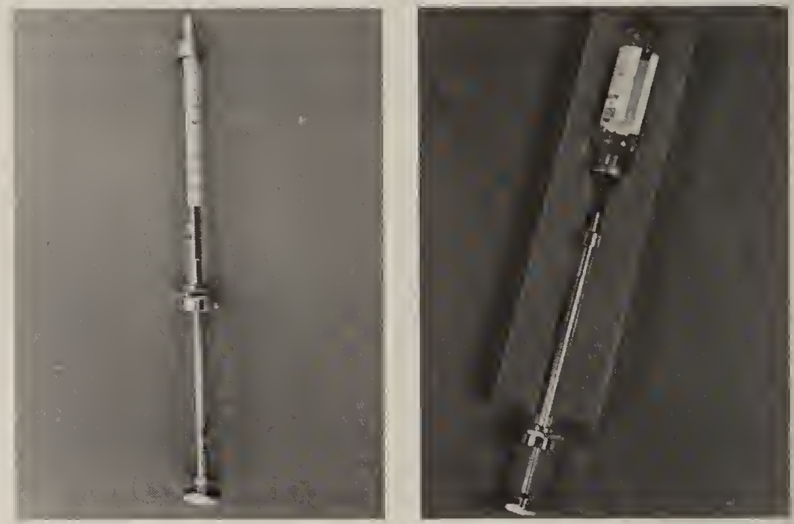
Inquire for price and availability

Independent Living Aids, Inc.
11 Commercial Court
Plainview, NY 11803

Price: $17.50
Order No.: 384890

Replacement Syringe
Price: $5.95
Order No.: 658225

Click-Count Syringe



Syringe measures approximately 5 inches in length. Consists of metal tip for connecting needles, glass barrel marked for one-unit increments of U-100 scale, metal base of syringe barrel, through which passes the shaft of the syringe plunger. The metal plunger shaft is notched at 2-unit intervals on one flat side, and the disk of its base is flattended on one side. Inside the metal base of the syringe barrel, the plunger shaft is gripped by two parallel pins. When the disk of the plunger base is turned so that its flat side aligns with a tactually prominent screw on base of syringe barrel, then the notched side of the plunger shaft is pulled under one of the parallel pins. Each notch clicks against the pin as plunger is withdrawn. Resistance is felt and a click is heard for each 2-unit increase. Thus air would be measured to pressurize vial. To inject air into vial, the plunger shaft would be turned one quarter revolution clockwise to free notched edge from parallel pins; this motion turns smooth sides of the shaft against the parallel pins—the "glide" position. Now the plunger may be pushed in smoothly to inject vial with measured amount of air. To withdraw prescribed dose of insulin, the disk of plunger base is turned clockwise until the flat edge again aligns with screw on syringe base. Now shaft is in position to indicate by clicks 2-unit increments as it is withdrawn. To withdraw plunger for insulin measurement, it is gripped between thumb and index finger close to syringe barrel. The grip is tightened and loosened with a squeezing action against base of syringe barrel. With the grip thus maintained close to barrel, the syringe shaft feeds through the fingers in movements of one notch at a time, always signaled by a click indicating 2 units of insulin. The dose can be checked by counting the exposed notch on the shaft with a fingernail. The number multiplied by two equals the number of units of insulin withdrawn into syringe. To inject, plunger shaft is turned to glide position and plunger is pushed in.

insulin withdrawn into syringe. To inject, plunger shaft is turned to glide position and plunger is pushed in.

Essential features: Requires sterilization. For use with U-100 insulin only. Can measure mixed doses. Manufacturer provides instructions.

Advantages: Simple in concept, beautifully machined, high grade materials. Accurate with careful, consistent, painstaking technique. Any dose may be measured at will independently.

Disadvantages: Requires highest degree of concentration, manual dexterity, hearing or tactual sensitivity, and patience. Slightest extra pressure during measurement can cause plunger to slide off setting to which it has been pulled.

Solutions: Practice under medical supervision is strongly recommended.

Hypoguard Limited
Dock Lane, Melton
Woodbridge, Suffolk
England IP12 1PE
Price: L 6.00

Needle Guides

AFB Needle Guide

Aluminum nut machined to fit vial cap of Eli Lilly insulin, AFB Needle Guide can be used with other brands but may not fit as snugly or may resist application and removal. Funnel-shaped interior of top guides needle to rubber stopper. Hexagonal base provides flat edges for gripping this relatively small object, but tactual sensitivity is still required. (A.R.V.) Sterilize guide to prevent needle contamination. Made of aluminum which may scratch and burr to catch or blunt needle.

American Foundation for the Blind
15 West 16th Street
New York, NY 10011
Price: $2.50
Order No.: MES 168

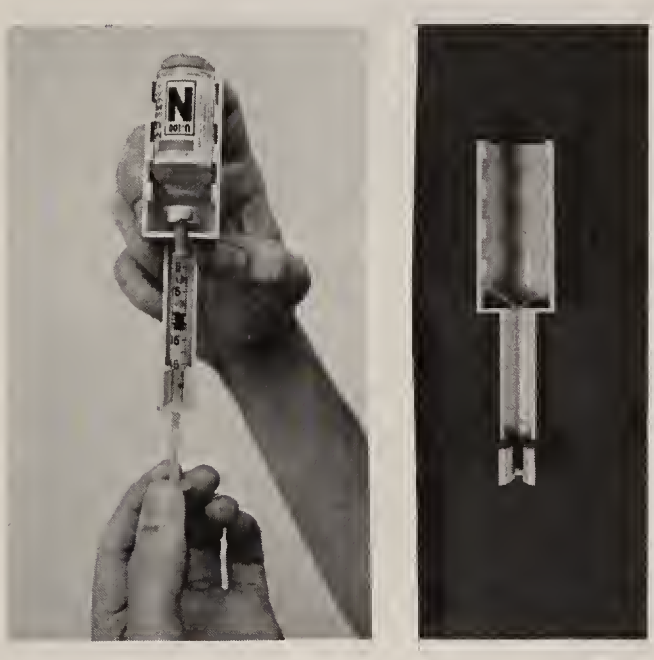
Centrepoint Needle Guide

Aluminum sheath, 1 3/4″, provides cradle for narrow vials of Nova range of insulins, which are manufactured in Denmark, distributed in Western Europe and United Kingdom, and have been recently marketed in the United States. Friction holds the guide in place, topped by high quality medical grade stainless steel funnel which guides needle to vial stopper. Sterilization by boiling is recommended preparation before each use.

Manufacturer reports production of another model to fit the Burroughs Wellcome range of insulin available in the United Kingdom. In addition, manufacturer intends to produce a Centrepoint to fit Eli Lilly brand of insulin in the near future.

R.N. Beard
15 Kings Ride
Blackfield
Southampton SO4 1ZN
England
Price: L 7.00

Holdease Needle Guide



Plastic cradle to hold vial aligned with trough to hold syringe. Barrel of syringe is held by clip molded onto trough while needle protrudes through slot in center divider to penetrate vial stopper on target. To prepare for use, cleanse divider with alcohol swab. Clean in warm suds; do not immerse in water hotter than 150°F (well below boiling). Ideally, no part of guide requires sterilization since no part interrupts path of needle to vial stopper. Manufacturer provides clear directions for use. Designed for standard American insulin vials but can be used with tall, narrow bottles common in Europe. Keeps vial and needle steady for easy handling as a single unit, even for those having coordination problems. (D.M.) Useful with staple templet or Insulgage. (R.B.C.)

American Foundation for the Blind
Consumer Products Department
15 West 16th Street
New York, NY 10011
Price: $11.75
Order No.: MDC 8120

Independent Living Aids, Inc.
11 Commercial Court
Plainview, NY 11803
Price: $9.95
Order No.: 37022

Meditec, Inc.
9485 East Orchard Drive
Englewood, CO 80111
Price: $9.75

Location Tray

Heavy, durable plastic foundation is impressed with shape of insulin bottle aligned with trough for glass insulin syringe. The bottle well will accept either the elongated European vial or the stocky American type; the syringe trough will accept *only* long, thin glass syringes such as type used in Click-Count Syringe. The Click-Count Syringe fits perfectly. With bottle and syringe aligned in tray, needle is directed to center of vial stopper. When in vertical position for insulin withdrawal, tray does not hold syringe and vial tightly. Plastic is smooth and rigid: it cannot hold vial and syringe by friction, and it has no clipping features. Manufacturer does not specify sterilization procedure.

Hypoguard Ltd.
Dock Lane, Melton
Woodbridge, Suffolk
IP12 IPE
England
Tel. 03943 7333

Price available on request from manufacturer.

Syringe Magnifiers

When contributors to this issue of AAR were surveyed regarding the available syringe magnifiers, it was revealed that most insulin syringe magnifiers have been found to be of limited use especially to the severely impaired population. Joyce Schulz offered the following information in response to a request for an evaluation of syringe magnifiers:

> For people with sufficient vision to read syringe calibrations visually, Monoject "Half CC" or B-D Lo-Dose disposable syringes are available. These syringes measure 50 units of insulin or less and are easier to read as each unit on the syringe is marked in large numbers.
>
> For those who desire more magnification, Char-Mag Company of Milwaukee manufactures a syringe magnifier that fits the entire length of the syringe and does not distort the numbers which are two advantages this device has over other syringe magnifiers. However, if a person has sufficient visual loss, possibly coupled with fluctuating vision, so that he or she cannot read the syringe, it is recommended that for safe and accurate measurement a non-sighted technique be used. Very often the magnification is sufficient to make the numbers readable but not the line calibrations between numbers.

For independent evaluation and inquiry, the following resources for insulin syringe magnifiers exist.

Char-Mag Syringe Magnifier

Device is a 2½″ bar magnifier that clips onto a B-D Long Plastipak U-100 Syringe or the Monoject 1 cc disposable plastic syringe. It extends the entire length of the syringe.

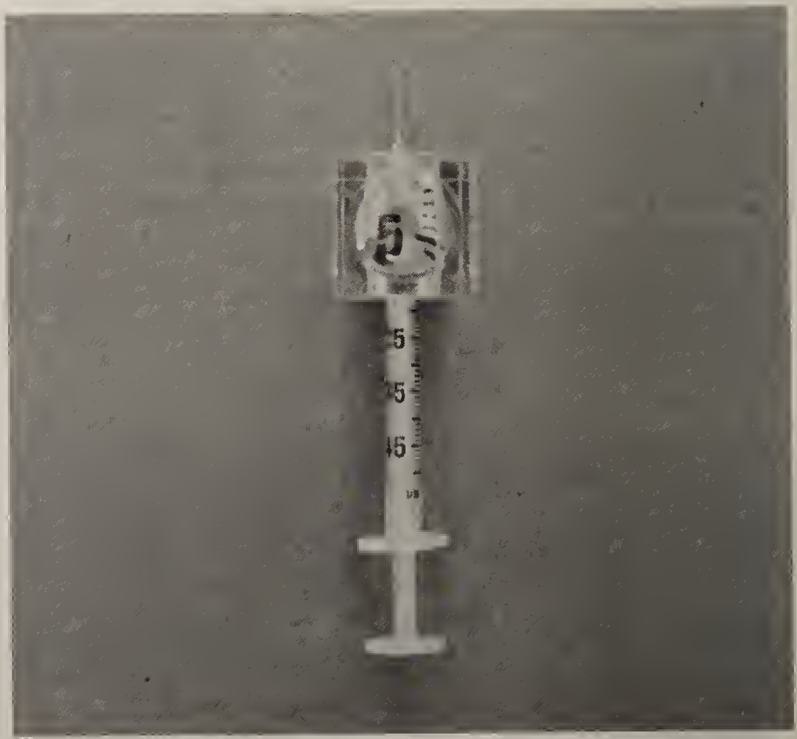
American Foundation for the Blind
Consumer Products Department
15 West 16th Street
New York, New York 10011

Price: $4.50
Order No. LMC 7100

Independent Living Aids
11 Commercial Court
Plainview, New York 11803

Price: $4.50
Order No. 074300

Monoject Syringe Magnifier



Device is a 3/4″ circular magnifier centered in a rectangular plastic housing that clips onto syringe in area of dosage to be measured. Will fit any plastic disposable insulin syringe, andy brand, any type.

Monoject
Division of Sherwood Medical
St. Louis, MO

Price: $1.98 (suggested retail)
Available through local pharmacies.

GLUCOSE LEVEL MONITORING

According to clinical definition, diabetes control means maintaining the concentration of glucose in the blood at levels within the range considered normal. Amount, kind, and timeing of food intake, of exercise, and of insulin injected can interplay to establish and maintain the blood glucose level within normal ranges. (Refer to "Diabetes: Some Physiological Considerations for the Blind Person.") Because the distinct but interrelated influences of diet, exercise, and insulin therapy converge to increase or decrease the amount of glucose in the blood, the blood glucose level can be seen to reflect the effectiveness of efforts to manage any one, or all, of the points of the network: diet, exercise, insulin therapy. Monitoring blood glucose levels is thus a crucial aspect of diabetes control. When levels rise above or fall below normal range, they can signal need for adjusting diet, exercise, or insulin dose.

Equipment for Urine Glucose Analysis

Either blood or urine may be tested to detect the concentration of glucose in the blood. Until recently, the method commonly used was the procedure of testing a urine specimen for glucose. Glucose in the urine often, but not always, results from higher than normal concentrations of glucose in the blood, since it is the function of the kidneys to cleanse the blood of any impurities (in this case, exessive sugar) and spill the impurities into the urine to be voided from the body. Thus, the percentage of urine sugar can reflect the percentage of blood sugar. (Refer to "Home Blood Glucose Monitoring for the Visually Impaired Diabetic" for an explanation of the limitations on interpreting blood glucose levels from urine glucose levels.)

Commercial Reagent Tests

The basic equipment for urine testing is (1) a second specimen of urine voided 30 minutes after a first void, during the hour before a mealtime, and (2) one of the several chemical tests available. The chemical tests consist of reagent material which reacts chemically with any sugar present in the urine and which indicates that reaction by changing to one of several specific colors; the specific color correlates with a specific percentage of sugar in the urine. (For a detailed evaluation of the four major commercial reagent products—Clinitest, Tes-Tape, Diastix, and Clinistix—consult the *Joslin Diabetes Teaching Guide.*) The test is accomplished by dipping the strip of reagent material into the urine specimen and matching the strip's resultant color change to a color chart labeled in respect to percentages of sugar indicated. With the Clinitest product, tablets are dropped into a carefully prepared urine specimen, and the entire specimen is observed for a change in color.

Obviously, vision loss can either interfere with comparing the color change to the color chart or can make it impossible. Even with remaining light and color perception, matching the colors can be a problem, since for all the products the closeness in hue of the individual colors can render them difficult to distinguish. For example, the Tes-Tape, approximately 1/4 inch wide, changes from yellow, to light green, to darker green/blue, to darkest green/blue. Though it might be possible to discriminate the extremes—yellow to indicate sugar-free, as distinguished from darkest green/darkest blue to indicate 2% or more—it can be highly problematic to identify the middle ranges. Likewise, Diastix colors have been perceived as too close in hue for certain discrimination—blue, light green, dark green, olive green, light brown, dark brown—to indicate certain percentages of sugar. A larger surface of reagent material has been found helpful to some people; the color change of a longer than normal strip of Tes-Tape, even though still narrow, can sometimes be distinguished with remaining vision. The pre-cut reagent strips called Diastix come in a larger, 1/2″ wide size, under the trade name Mega-Diastix. For some people the color changes of this product are distinguishable.

Audible Urine Analyzers

Electronic devices which can sense the specific color changes on reagent material and which can audibly signal the specific color provide an alternative to sight in testing urine for glucose percentage.

The Uricator, manufactured by Science for the Blind, electronically detects and compares the color changes on a strip of Lilly Tes-Tape; it audibly indicates the color and thus the glucose percentage. The cassette tape which accompanies the *Uricator* provides the technical description of the device along with step-by-step instructions for operating it, as follows.

Housed in a black plastic box, which measures 5″ x 4″ x 1 1/2″, the *Uricator* operates on a nine volt battery. The box rests on four small rubber feet. On the top surface of the box toward the front is a row of four push buttons; behind the push buttons on the right is a small toggle switch, which turns the unit on. To the left of the toggle switch is the test block consisting of two small, parallel bars about 1/2″ apart. The sensing window lies in the space between the two bars. A hinged cover closes down between the two bars and over the sensing window.

The device operates as follows. A urine specimen is first prepared in the usual way. A one or two inch strip of Tes-Tape is pulled from the roll and dipped in the urine; after a wait of one minute, the wet tape is placed in the slot and over the sensing window, between the two raised bars, and the hinged lid is closed and held down over the tape to keep it flat and to keep out extraneous light. Under the tape, the sensing window consists of a square of transparent plastic covering a hole through which a light from inside the box shines onto the under side of the tape, then reflects back through the hole to the sensor. The sensor's response is proportional to the color of the tape. With the hinged cover held down lightly on the tape, the four buttons are pushed in succession, beginning with the leftmost button, until one of the buzzers sounds, indicating the sensor's response. If the first button sounds (yellow), it indicates no sugar; if the second buzzes (light green), 1/10%; if the third (darker green/blue), it signals 1/4%; and if the fourth (darkest blue/green), 2% or more.

One of the critical aspects of this test is the one-minute lapse of time between dipping the Tes-Tape into the urine and testing for the color change; this exact amount of time is required for the reagent material to respond to any percentage of glucose and change colors. So that the person using the *Uricator* does not have to time the minute somehow, the timer is built into the unit. The Tes-Tape is dipped into the urine *just before* the toggle switch activating the machine is switched on. Switching the toggle switch to "on" not only activates the device but also starts the one-minute timer built into the machine; a buzz sounding from within the box indicates that the critical one minute has elapsed; the Tes-Tape, having made any color change, is ready for detection. The machine will then be active, capable of sensing and indicating the specific color change, *only* for the next *30 seconds*. Within that 30 seconds it is crucial to place the wet tape into the slot of the testing block, pull down the hinged lid, hold it gently down over the tape, and push the testing buttons in succession, until one sounds. If the test has not been completed within the 30 seconds following the "activated" buzz, then the machine must be turned off, and the test performed all over again through each step of the sequence using a new strip of Tes-Tape. The original strip will not give accurate results for a second test.

The time limit of 30 seconds is said to be adequate for most *practiced* users. It is emphasized that for initial tests with the device, the user should practice with sighted help so that double-checks may be made on the tape's color change and the device's audible signal. For persons who have access to sighted help and to a *blood* glucose monitoring device, the results of the Uricator analysis may also be compared with those of direct blood glucose testing. (For one *Uricator* user in the Boston, Massachusetts, area, the *Uricator's* results compared favorably with the results of her blood glucose monitor, whose digital display of glucose percentage was read by family members.)

So far, one limitation of the *Uricator* has been noted: its accuracy depends on the accuracy of the reagent material used, Tes-Tape. In many circles there is some controversy regarding the accuracy of Tes-Tape; it is felt that the color changes in the upper ranges are too ambiguous to make the tape reliable for glucose percentages above 1/2%.

But some *Uricator* users have reported much satisfaction with the device. One person interviewed compared the results of the Uricator with other methods of urinalysis undertaken with sighted help: she observed that the *Uricator* results were, for her, just as accurate. Certain overall contributions of the device have been reported also. To a homemaker, who manages diabetic control independently during daylight hours, the *Uricator* gives the capability of objectively confirming any high glucose levels; with this information, she can decide either to plan different foods or eat less for a few meals, or to take time out for walking, stationary cycling, or swimming—activities in her regular exercise program. She states enthusiastically that using the *Uricator* makes her feel more in tune with herself and more in control of her life. The catalogue of Science for the Blind tells of the experience of another *Uricator* owner: "During a bout of flu he monitored his sugar level closely, eating or not at bedtime, depending on the level, and not disturbing his wife to help with a test in the middle of the night."

Uricator

Science for the Blind Products
Box 385
Wayne, Pennsylvania 19087
(215) 687-3731

(Calls for orders or information are taken 10 a.m. to 10 p.m. each day.)

Price: $125.00
Order No.: T-16

The Hypo-Test Audio Urine Meter is produced by Hypoguard Ltd. in England and is not yet available in the United States. However, upon approval by the Food and Drug Administration, the company plans to explore with the American Foundation for the Blind the possibility of marketing the *Hypo-Test* in the U.S.A. Like the *Uricator*, the *Hypo-Test* is a compact plastic box; the top surface contains the test block for holding the wet Diastix as well as the knob turned to activate the indicator-buzzer. The company provides the following current product specifications:

> This instrument measures glucose levels in urine in conjunction with an Ames Diastix. Range: 0%-2%. Accuracy: Instrument only + 5%. Power: Batteries rechargeable—100 operations between charges. Size: 16cm x 10cm x 6cm. Temperature: Designed for operation in temperatures of 0 C—50 C. Features: Timer gives audible signal for drying Diastix; Results are communicated by buzzer code for the following values: 0%, 1/10%, 1/4%, 1/2%, 1%, 2%; an abort signal sounds if user delays in completing the test sufficiently to make test inaccurate; a special battery test function allows battery level to be checked prior to urine test. The Diastix holder can be removed from the device for washing.

Hypo-Test

Hypoguard Ltd.
Dock Lane, Melton
Woodbridge, Suffolk
England 1P12 1PE
Tel: Woodbridge (03943) 7333/4

A homemade urine-glucose analyzer with an audible code can be built from components purchased from an electrical supply store. One such device is described in the March 1977 issue of *Diabetes*, volume 26, pages 192-195; it is called the *Audio-Urine-Glucose Analyzer*. The authors of the article, who developed the machine, describe its construction and their testing of it. Provided as well are essentials for constructing and using the device: the circuit diagram, instructions for calibrating the device, instructions for operation. The authors estimate a cost of $150.00 (1977 prices) for materials and about 24 hours of work.

Yeast Method

An alternative method of urine-glucose analysis, which might be called tactual, is the yeast method. Though it can be messy, cumbersome, and time-consuming, the procedure is still used by some people. It is based on the fact that glucose reacts with yeast to produce a gas, carbon dioxide. A test tube containing the urine specimen (approximately 12 cc) receives 1/4 teaspoon of yeast; a finger cot is then placed over the test tube opening. After about 10 minutes, if glucose is present in the urine, the yeast reacts with it to produce carbon dioxide; the gas expands to inflate the finger cot covering the test tube. The relative tautness of the inflated finger cot can be felt to determine the approximate amount of glucose present—none, a moderate amount, a great deal. The information gained is only a rough indication. Yet even with its obvious limitations, the method may be appropriate for some people seeking independence in urine-glucose analysis with vision loss.

For all of the methods of urine-glucose analysis described, the advantages are to be weighed against limitations, and, of course, any selection of method must take into consideration the particular needs and capabilities of the person using the method—amount and kind vision loss, hand motor skills (though no extraordinary ones are needed), motivation. In addition, it should be remembered that there are limitations to the value of urine-glucose testing explained in the following article, "Home Blood Glucose Monitoring for the Visually Impaired Diabetic."

Home Blood Glucose Monitoring for the Visually Impaired Diabetic

by

Judith W. Oehler, R.N., Ed.D.

Home blood glucose monitoring is perhaps the most exciting innovation in the treatment of diabetes since the discovery of insulin. With a disease which must be patient-managed, it is inspiring that diabetologists have realized the importance of providing to the diabetic the opportunity to monitor blood glucose, a responsibility previously restricted to the physician.

As indicated by the title of Dr. Charles Peterson's book, *Take Charge of Your Diabetes*, home blood glucose monitoring enables the individual to take charge rather than to be controlled by the diabetes. In addition, "The assumption by patients of the responsibility for management of their own disease tends to break the pattern of nihilism and frustration often found in both patient and physician."[1] Finally, home blood glucose monitoring teaches even the veteran with diabetes new information regarding the effect of insulin, food and exercise upon the blood sugar.

Urine testing, the traditional method for monitoring diabetes self-care, provides only an indication of how high or low the blood sugar actually is. Normally, one's blood sugar should be between 70 and 140 milligrams per deciliter (mg/dl) of blood. Ninety mg/dl is the normal premeal blood sugar. Glucose or sugar normally spills into the urine (renal threshold) at 180 mg/dl. Consequently, a negative (blue) urine test with Clinitest indicates that the blood sugar is 180 mg/dl or lower, but not how low, and can reflect a blood sugar ranging anywhere from 0 to 180 mg/dl. A trace reading with Clinitest indicates that the blood sugar is at least as high as 180 mg/dl. A four plus (yellow or orange) Clinitest reading indicates that the blood sugar is high, but not how high. Blood sugar in this case can be 350 mg/dl or higher. Another problem with urine tests is that the renal threshold of long-term diabetics may be altered so that glucose may spill into the urine at a point above 180 mg/dl. In such cases urine tests appear lower than they actually are. In general, while urine testing provides one with a "hunch" as to what the blood sugar is, home blood glucose monitoring provides an exact reading.

The individual experiencing vision loss from advanced diabetic retinopathy may be frustrated with the inadequacies of urine testing, and yet may also be frustrated by the difficulty or inability to perform home blood glucose monitoring because of the visual impairment. Rather than approaching this situation helplessly, it is the opinion of this author that the individual must say to himself or herself, "If home blood glucose monitoring is important to me, I will find a way to have the test performed in spite of my visual impairment." It is also the opinion of this author that the easiest way to initiate a program of home blood glucose monitoring, is to begin by using the Chemstrip bG system manufactured by Biodynamics. Chemstrips do not require the use of a reflectance meter, or wash bottle and sink, they are extremely portable, and they are easy to read because the strip has two color reagent zones. Blood is placed on the reagent zone and wiped off with moderate pressure using cotton or tissue sixty seconds later. After waiting four minutes, the colors of the reagent zones are compared with color blocks ranging from 20 to 800 mg/dl which are on the Chemstrip bottle. Because of its simplicity, the low vision diabetic may be able to perform the Chemstrip test, but should there be difficulty matching the strip to the color blocks, it can be saved and read by another person later, as the strip remains stable. If the diabetic cannot perform the Chemstrip test, it is relatively easy for family, friends or readers to learn the procedure. The portability of the test permits it to be conducted in the office of a colleague, the home of a friend, or in any other location.

Chemstrips can usually be ordered through a local pharmacy. Each bottle contains 25 strips. The expense of the strips and the amount of blood needed to cover the two reagent zones on a strip can be reduced by cutting Chemstrips in half lengthwise. When cutting strips, it is important not to touch the reagent area, and when cutting is finished, strips should be placed immediately back in the bottle for storage.

Reflectance meters or home blood glucose monitoring machines are also available. The main advantage of these machines is that they read the strip directly so that visual inspection of color zones is not necessary. However, the main drawback of these machines is that they are expensive as well as somewhat more complicated to use. Both Ames Company and Biodynamics Company manufacture reflectance meters in the United States. The term reflectance meter refers to the amount of light reflected or absorbed by the reagent area which is dependent on the amount of glucose in the blood. With the STATTEK from Biodynamics, blood is placed on a STATTEK strip and wiped off after sixty seconds. After an additional sixty seconds, the strip is placed in the STATTEK machine which reads the amount of sugar on the strip in a manner similar to a scale. The meter provides readings from 50 to 350 mg/dl.

In 1970, Ames Company produced the EYETONE meter. This was the first reflectance meter available to measure blood glucose using a reagent strip. In the early 1980's, Ames developed the DEXTROMETER, a lighter machine than the EYETONE, which provided a digital read out of the blood sugar, and had the ability to be operated by a battery pack. The DEXTROMETER sells for $275. Soon after the DEXTROMETER was on the market, Ames developed the GLUCOMETER specifically for use by patients.

The GLUCOMETER which lists for $250 is lighter than the DEXTROMETER, is battery operated, has a digital read out, and in addition a built in timer which indicates when the strip should be washed off. With all Ames machines, the Dextrostix must be used, and the strips must be washed off with a stream of water at a specific time.

Studies have shown that the results of blood tests performed by diabetics in the home are as reliable as those performed in the laboratory. In addition, Chemstrips have been found to be as effective as tests performed by the reflectance meters.

Most people find the easiest method for obtaining a drop of blood from the finger is to use the Autolet manufactured by Ames, which takes the Monolet lancet manufactured by Monoject. The Autolet is a device into which a lancet is placed so that when a button on the device is pressed, the finger is automatically lanced or pricked. To obtain a drop of blood, the finger is swabbed with alcohol and wiped dry with a tissue or allowed to dry. (Alcohol distorts the test.) Before lancing the finger, if it is cold it may be warmed in water or massaged to get the blood flowing through it. Tissue juices squeezed out with the blood will not distort the results. The sides of the finger between the tip and first joint should be used rather than the pad of the finger where nerves are concentrated. Once the finger is pricked, a drop of blood should be "milked" out by dropping the finger below the heart, and slowly massaging it until a drop of blood forms. When a drop of blood has formed, the strip is brought to it, and the drop of blood is transferred from the finger to the strip. Smearing should be avoided, and the entire reagent area should be covered.

None of the home blood glucose monitoring systems have been adapted for use by the visually impaired diabetic. For the individual severely visually impaired from advanced diabetic retinopathy, the most difficult step would be transferring the drop of blood from the finger to the strip. However, if it were important to the individual, even this step could be mastered. Because it would be difficult to master this step, companies which manufacture reflectance meters have not invested money in adapting machines for the visually impaired. However, this author believes that the more phases which the visually impaired diabetic can control during the blood test, the easier it will be for him or her to become involved in home blood glucose monitoring. Therefore, it would be of benefit to the blind diabetic if the reflectance meters had auditory output. The more steps the visually impaired diabetic can control, the easier it is for him or her to instruct a sighted individual to assist with the remaining steps in the test.

Since use of Chemstrips bG is relatively easy to learn, the visually impaired diabetic may want to begin home blood glucose monitoring using this system. If the blind diabetic familiarizes himself or herself with this system, he or she may supervise a sighted person performing the test. Public Health and Visiting Nurses as well as representatives of Ames and Biodynamics can be helpful in instructing visually impaired diabetics and sighted blood testers in proper techniques. State and Chapter affiliates of the American Diabetes Association can be helpful in supplying information on local representatives of these companies, and on medical companies supplying test strips, Autolets, lancets and related equipment.

In general, persons who conduct home blood glucose monitoring have the advantage of knowing precisely what their blood sugar is, and of learning how specific amounts of food, insulin, and exercise affect their blood sugar. Another advantage is improved well-being and lessened depression. It is possible that maintaining normal blood sugar (euglycemia) can prevent or delay the onset or progression of eye, kidney and nerve complications. Many diabetics who embark on programs of home blood glucose monitoring, find that the condition of neuropathy improves. Episodes of hypoglycemia have been reported to decrease, and in one study, symptoms of hypoglycemia previously identified were actually found to be related to normal or high blood sugar. Another advantage of blood testing is that the blood pressure and pulse often decrease resulting in less strain on the heart. Finally, an important advantage is that diabetics who test their blood sugar involve themselves as partners in controlling their chronic disease, with their physicians acting as consultants.

The main disadvantage of blood glucose monitoring is the expense of the strips and reflectance meters, and the commitment of time. Time involved in blood testing decreases with familiarity. Initially, the need to lance the finger may seem like a drawback, but just as one becomes accustomed to insulin injections, one becomes accustomed to finger pricks.

Record keeping is extremely important so that one may act on the results of the blood test. Results may be documented by use of tape recorder, or notebook when sighted persons assist with the test. The GLUCOMETER has a built in mechanism for recording test results. Initially, seven blood tests should be performed daily, before each meal, one hour after each meal, and before bed. For approximately two weeks the date, time of test, amount of insulin taken, exercise schedule, hypoglycemic episodes and other relevant information should be recorded. Records should be discussed with the physicians who will advise an appropriate alterations in the regime. Once euglycemia is attained, two to four blood tests daily are optimum.

Perhaps the most helpful book which has been published on the subject of home blood glucose monitoring is *Take Charge of Your Diabetes* by Charles M. Peterson, M.D. The book has been recorded by Recording for the Blind (215 East 58th Street, New York, New York 10022). An inkprint copy may be purchased for $3.95 form P.O. Box 9754, St. Paul, Minnesota 55197. It would be advisable to read this book before embarking on a home blood glucose monitoring program. In addition the July-August 1980 issue of *Diabetes Forecast* has an excellent article which discusses this subject.

It is extremely important that the visual impairment not interfere with testing urine or blood for glucose. The visual impairment may make it more difficult to initiate a program, but once a program is developed, the individual will find it becomes routine.

REFERENCES

1. Peterson, C.M., Forhan, S.E. and Jones, R.L. "Self-Management: An Approach to Patients With Insulin-Dependent Diabetes Mellitus." *Diabetes Care*, Vol. 3, No. 1, Jan.-Feb., 1980.
2. Birch, K., Hilldebrandt, P., Marshall, M.O. and Sestoft, L. "Self-Monitoring of Blood Glucose without a Meter." *Diabetes Care*, Vol. 4, No. 3, May-June, 1981.
3. Jovanovic, L. and Peterson, C.M. "Is Home Blood Glucose Monitoring For YOU?" *Diabetes Forecast*, Vol. 33, No. 4, July-Aug., 1980.

DIET AND EXERCISE MANAGEMENT

Diet

The effects of food and exercise on blood glucose levels have been and continue to be subjects of diabetes research. In respect to food, it is traditional clinical practice to prescribe a diet balanced in protein, fat, and carbohydrate and planned for calories as one component in glycemic control.

For many diabetics, a correlation between eating concentrated sweets and experiencing steep rises in blood glucose levels has been observed; thus, candy, pastry, and other foods saturated with simple sugar are eliminated from the orthodox diabetic diet. In addition, calories are controlled to fit exactly the person's energy requirements: calories are kept to the minimum to maintain ideal weight, since it has been observed that excess body fat can interfere with the cells' use of insulin; yet calories are also held at levels sufficient to balance the insulin dose, to prevent blood glucose levels from falling below normal.

In order to plan meals and prepare foods in accordance with this diet, information on food content is necessary along with recipes calculated for calories and for carbohydrate, protein, and fat in the prescribed balance. Exchange lists provide information on food content by dividing specific foods among basic categories such as milk, vegetable, fruit, bread, and meat. A measure of a specific food within a category will equal 1 Exchange—for example, 3 tablespoons of wheat germ equals 1 Bread Exchange. Exchange lists are used in conjunction with the diabetic diet, also called the diabetic meal plan, which details numbers and kinds of exchanges permitted each meal daily. Basic information on food composition is available in books on nutrition and in bulletins published by the U.S. Department of Agriculture. Exchange lists and meal plans are available from the American Diabetes Association, headquartered at 2 Park Avenue, New York, N.Y. 10016, with local affiliates across the country; diabetic clinics associated with large hospitals frequently prepare and provide their own exchange lists and meal plans tailored to the individual diabetic. Diabetic cookbooks provide recipes for dishes to fit the diabetic meal plan, and they are available, along with exchange lists and books on nutrition, in braille, on cassettes or disks, or in large print editions. A partial listing follows, and includes other cookbooks which are adaptable to the diabetic diet and available in nonvisual media or large print.

Resources

Breads: Guild Tested Recipes
Marie Porter, Editor
Chicago: The Guild for the Blind
50 recipes for wholesome yeast breads. (But recipes for quick breads contain much simple sugar.)

The Guild for the Blind	Braille
180 North Michigan	Cassette
Chicago, IL 60601	Large Print
(312) 236-8569	Price: $6.00

The Calculating Cook
by Jeanne Jones
San Francisco: 101 Productions, 1978
French sauces, Mexican dishes, curries, and other exotic food adapted for diabetic diet. Approved by the American Diabetes Association.

101 Productions	
834 Mission Street	
San Francisco, CA 94103	
or	
Charles Scribner's Sons	
Book Warehouse	
12 Breeland Avenue	Print
Totonia, NJ	Price: $5.95
and	
The Lighthouse for the Blind	
111 East 59th street	Braille
New York, NY 10022	Price: $34.00

A Cookbook for Diabetics
Pittsburgh: Forbes Health Systems, 1976
Recipes with exchange breakdowns; exchange breakdowns for commercial, processed foods.

Education Department	
Forbes Health Systems	Print
500 Finley Street	Price: $2.50
Pittsburgh, PA 15206	Postage: .50

American Printing House	
for the Blind	
1839 Frankfort Avenue	
P.O. Box 6085	
Louisville, KY 40206	Braille
(502) 895-2405	Price: $11.00

Cookbooks for People with Diabetes
Selected Annotations, Prepared by the
National Diabetes Information Clearinghouse, May 1981

Listing of 44 cookbooks published since 1976. Ordering information given.

National Diabetes Information Clearinghouse
805 15th Street, N.W., Suite 500
Washington, D.C. 20005
Print
(202) 842-7630
Price: Free

Craig Claiborne's Gourmet Diet
by Craig Claiborne and Pierre Franey

Haute cuisine: low salt, low fat, beefless recipes.

Print
Local bookstores, libraries
Price: $2.95/paperback
$10.95/hardcover

Regional Library for the Blind
and Physically Handicapped
or
Library of Congress
Division for the Blind
and Physically Handicapped
1291 Taylor Street, N.W.
Disk: Order No. RD 15781
Washington, D.C. 20542
Cassette: Order No. RC 15781

The Diabetic Gourmet
by Angela Bowen, M.D.
New York: Harper and Row, 1970

Family meals, diabetic recipes, emphasis on unsaturated fats. Carbohydrate, protein, fat content for individual portion.

Print
Local bookstores, libraries
Price: $10.95

Regional Library for the Blind
and Physically Handicapped
or
Library of Congress
Division for the Blind
and Physically Handicapped
1291 Taylor Street, N.W.
Washington, D.C. 20542
Disk: Order No. TB 3733

Diabetic Menus, Meals, and Recipes
by Betty M. West
Garden city, New York: Doubleday and Company, Inc.

Recipes with breakdowns for calories, vitamins, minerals, exchanges.

Doubleday and Co., Inc.
501 Franklin Avenue
Garden City, NY 11530
Print
(516) 294-4561
Price: $7.95
and
G.K. Hall
70 Lincoln Street
Large Print
Boston, MA 02111
Price: $12.95

The Diabetic's Total Health Book
by June Bierman and Barbara Toohey
Los Angeles: J.P. Tarcher, Inc., 1980

Balances various perspectives on diet provided by new trends in nutrition and insulin therapy; looks at exercise with diet and blood sugar control.

Sugarfree Center for Diabetics
5623 Matilija Avenue
Print
Van Nuys, CA 91401
Price: $10.95
Also available at local bookstores, libraries.

Diet and Nutrition: A Holistic Approach
by Rudolph Ballentine, M.D.
Honesdale, Pennsylvania: The Himalayan
International Institute, 1979

Basic explanation of physiology of food intake, digestion, and metabolism, including body's use of complex carbohydrates (whole grains, legumes, etc.) in holistic context.

Himalayan International Institute
Print
Honesdale, PA
Price: $8.95

Regional Library for the Blind
and Physically Handicapped
1291 Taylor Street, N.W.
Washington, D.C. 20542
(202) 882-5500
Cassette: Order No. RC 15777

Easy Cooking for One or Two
by Louise Davies

Written by specialist in geriatric nutrition. Emphasis on nonmeat protein.

Mrs. Audrey Artus
ADA Reading Service
12 Renhold Road
Cassette
Wilden, Bedford
To order: send self-addressed stamped
England
envelope with 2 C60 cassettes.
Telephone: Bedford (0234) 771693
Price: Free
and
Magna Print Books
Magna House
Long Preston, near Skipton
North Yorkshire BD23 4ND
England
Large Print
Telephone: Long Preston (07294) 225
Price: L5.50

The Elegant Touch Cookbook: Gourmet Cooking for the Diabetic
by Marjorie Zats and Karen Rubin
Minneapolis: Jonathan David Company

Classic European cuisine adapted to diabetic diet: menu suggestions, caloric values, exchanges, cooking hints.

Jonathan David Company
540 Taft Street, N.E.
Large Print
Minneapolis, MN 55413
Price: $9.45

Encore
compiled and recorded
by Library of Congress

A bimonthly "talking" magazine. Includes *Diabetes Forecast*, which contains articles on diabetes, recipes, resources, etc.

Regional Library for the Blind
Cassette available through
and Physically Handicapped
direct circulation.

Exchange Lists for Meal Planning
prepared by American Diabetes Association

Wide variety of common foods ranked in exchange lists according to food category and measure.

Volunteer Braille Services
P.O. Box 1592
Houma, LA 70361
Cassette
(504) 872-9658
Price: $5.00
and
Regional Library for the Blind
and Physically Handicapped
or
Library of Congress
Division for the Blind
and Physically Handicapped
1291 Taylor Street, N.W.
Washington, D.C. 20542
(202) 882-5500
Cassette: Order No. RC 165

Look 'N Cook
by Ida Erickson
Willmar, Minnesota: Biword, 1980
Includes chapter of recipes for diabetics. Hearty favorites (spaghetti, stew, macaroni and cheese) with exchange breakdowns.
Biword Publications — Large Print
Box 20 — Price $9.95
Willmar, MN 56201 — Postage & Handling: 2.00

Exercise

The role of exercise in diabetes control is less certain than that of diet. Generally, in providing information on diabetes control, medical professionals state that exercise is desirable, and they point out its blood glucose-lowering effects in conjunction with insulin; they mention that exercise can play an important part in the treatment of diabetes (Joslin's *Diabetes Mellitus*, p. 291). But the effects of exercise on blood glucose level are not consistent. It has been observed that sudden bouts of rigorous exercise, especially when they interrupt a sedentary life style or a period of inadequate insulin, can actually raise blood sugar. Extremely vigorous, prolonged exercise, such as mountain climbing under the extra stress of high altitudes, has likewise been observed to raise rather than lower blood sugars even with insulin adequate according to calculations and even with carefully prepared physical fitness (Oehler, *Diabetes Forecast*, 34(6), Nov/Dec 1981). It would appear that medical research is needed to continue efforts to describe the effects of exercise on diabetes under varying conditions.

Yet moderate and consistent exercise has been observed to lower blood sugar levels, to improve circulation, and to reduce stress. Resources for exercise programs follow.

Resources

Be Alive as Long as You Live: The Older Person's Complete Guide to Exercise for Joyful Living
by Lawrence J. Frankel and Betty Byrd Richard, 1980
Gentle exercise to be performed from standing, sitting, and lying positions to improve circulation, tone muscles, increase flexibility, relieve tension and stress.
Regional Library for the Blind
and Physically Handicapped
or
Library of Congress
Division for the Blind
and Physically Handicapped
1291 Taylor Street, N.W.
Washington, D.C. 20542
(202) 882-5500 — Cassette: Order No.

The Diabetic's Sports and Exercise Book
by June Bierman and Barbara Toohey
New York: J.P. Lippencott Co., 1977
Effects of exercise on mind, body, insulin requirements, diet; exercise programs; coping with insulin reactions.
Sugarfree Center for Diabetics
5623 Matilija Avenue — Print
Van Nuys, CA 91401 — Price: $10.95
Also available in local bookstores, libraries.

Sports and Exercise for People with Diabetes
Selected Annotations, Prepared by the National
Diabetes Information Clearinghouse, Jan. 1981
Annotated bibliography of print materials, educational films, and research studies on exercise and diabetes.
National Diabetes Information Clearinghouse
805 15th Street, N.W., Suite 500
Washington, D.C. 20005 — Print
(202) 842-7630 — Price: Free

Techniques for Foot Care by the Visually Impaired Diabetic

by

Allene R. VanSon, R.N.

A commonly experienced medical problem with diabetes is impairment of the healing process which can result in infection, especially in the extremities since blood circulation there tends to be more restricted. For the diabetic, then, foot care can become essential.

The material below is designed to encourage independence and self-management of compulsory foot care for the visually handicapped person with diabetes mellitus. The text addresses the consumer and aims to give step-by-step instructions in foot care.

Not only is your body changing because you are growing older; you have diabetes. Diabetes affects your blood vessels and nerve endings, including those in the feet and legs. Normally, blood travels through the arteries and veins carrying nourishment and oxygen to the cells and removes waste products. But in time these blood vessels can become narrow and plugged or hard and stiff, losing their ability to move blood easily. The resulting decreased circulation to the feet and legs can lead to a variety of complications. When nerve endings are affected by diabetes, pain can occur in feet and legs, especially at night. But actual sensitivity is decreased, which diminishes the ability to monitor heat, cold, and pain quickly; therefore, burns, frostbite, and injury can occur without awareness. Also there is a tendency for calluses and toenails to grow hard and thick, and these changes can lead to additional problems. Together these factors can produce ulcers and injuries that do not heal easily; further, gangrene can develop and result in amputation of toes, feet, or legs. Attention to foot care is an essential step in helping to prevent these serious complications.

Things You Can Do to Protect Your Feet

Control your blood sugar. Use meal plan, medication, and exercise designed to help keep blood sugar levels between 60 and 120 mg. fasting.

Wash feet daily unless skin is dry; then wash every other day. Check temperature of water by putting a drop on inside of wrist. If drop feels warm, but not hot, water is ready for use. *Do not* soak feet because soaking dries the tissues by washing out natural oils.

Use mild soap containing oil or lotion; Tone soap or Dermassage lotion are good choices.

Use a soft washcloth to rub off the dry skin gently.

Pat completely dry, especially between the toes.

Lubricate the skin at night with creams or lotions.

Check the condition of your feet daily. Gently run your hands all over your feet and legs. Note andy changes in the skin, e.g., dryness, callus formation, or injury.

Wear clean socks or stockings (hose) to protect your skin from the shoes. Hose with holes or mends may cause an injury.

Make certain that shoes fit comfortably and are in good condition. Remember that sandals and open-toed slippers do not protect your feet. Always use your hand to check the shoe for cracks, rough spots or objects before placing the shoe on your foot. Always "break in" new shoes by wearing them for one to two hours each day, for one to two weeks.

Take action if an injury occurs:

Small cuts: Stop the bleeding, wash with warm water, cover with dry sterile dressing. Seek help.

Blisters: Do not open the blister. Cover with a dry sterile dressing. Seek assistance.

Small burns: Immediately place burned area in cold water. Cover with a dry sterile dressing. Seek help.

Larger cuts and burns: Seek help.

Foot or leg ulcers: Give *special* attention. Follow *all* medical advice for soaking the area or applying medication and dressings. Enlist someone—a friend, relative, medical professional, etc.—to view the area daily.

Prevent burns! Use warm socks instead of hot water bottles, heating pads, or direct contact with radiator to warm feet.

Wear warm, dry boots to prevent frostbite in winter.

Keep toenails trim. File with an emery board; follow the curve of the toe. First soak feet in warm water for five to seven minutes to soften the nails before filing.

Things Someone Else Must Do to Protect Your Feet

A podiatrist or family member can file, clip, or cut your toenails following the curve of the toe. You can reduce the number of times you need help by using the emery board weekly.

Your feet and legs must be viewed at least once each week; a more frequent inspection is desirable.

Corns and calluses must be removed by a podiatrist.

Injuries require medical assistance.

Things to Do to Improve the Circulation in Your Feet and Legs

Develop a daily walking program with your doctor's permission.

Increase the distance and the rate of walking gradually. Use the heel-toe method of walking.

Do not sit still for long periods of time. Move about frequently. Wiggle your feet and toes while sitting.

Do not cross your legs.

Do not wear constricting garments or garters. They restrict the blood flow.

Nicotine slows the blood flow to your feet and legs; therefore, you are encouraged not to smoke.

It is your responsibility to take care of your feet and legs and to seek help when you need it, before a problem develops.

Resource

Time Out for Foot Care (anon)
Minneapolis: Metropolitan Medical Center, 1977

This is an illustrated outline of the Buerger-Allen exercises designed to increase foot comfort and improve blood flow to and from the feet. Eight guidelines to good foot care are also given.

Diabetes Education
Metropolitan Medical Center
900 South Eighth Street
Minneapolis, MN 55404
(612) 347-4654 Price: $0.25; $2.50/12

The Role of the Rehabilitation Center in Serving the Diabetic Person

by

Laura Marletta, M.Ed.

Not addressing the issue of diabetic control with the visually impaired diabetic in a rehabilitation setting is overlooking a major component of that person's rehabilitation program. If the diabetic client is not under the best possible control, that individual will not be able to work to the best of his/her ability. Participation in a rehabilitation program requires a great deal of physical stamina and mental alertness. The person with diabetes cannot afford to be feeling "sick."

Actually, control of the disease should be sought before the person is sent to a rehabilitation center. This effort could be coordinated by the rehabilitation counselor. A complete physical examination is part of the vocational rehabilitation process. The counselor could request specific information and recommendations from the physician on diabetes control. "Is the individual motivated toward good control?" Most large hospitals offer diabetes training programs. If the prospective client has not attended such a program, or it has been a number of years since attendance, the counselor should request the client attend a program as part of the total rehabilitation program.

Diabetic clients are not always unwilling to attend classes on diabetes; however, transportation and participation in the classes can be problems for the visually impaired person. The counselor should assume responsibility for alleviating these problems. Some people may get defensive when asked to attend such a class and state they know everything there is to know about diabetes. "After all, I have lived with it all my life!" However, if the onset of diabetes was during childhood, much information was perhaps learned indirectly at home twenty odd years ago. Much information has changed since then and is constantly changing as new developments are made.

In the past, much of the more technical information was withheld from the patient for fear of overburdening or frightening him. I believe ignorance of one's disease is what causes fear. Accurate information can provide the individual with the freedom to control his/her disease—preventing the disease from controlling the person.

A good time to review what is known about diabetes control is when the visually impaired diabetic enters the rehabilitation center. This can be done by anyone on the rehabilitation team possessing up-to-date, accurate knowledge about diabetes. Questions can be asked informally. For example: "What caloried diet are you on?" "How many exchanges are you allowed at each meal?" "How do you adjust for high urine/blood glucose tests?," etc. A more formal questionnaire can be devised to pinpoint areas where more knowledge is needed, or any problems the individual might be having with control.

Diabetics enrolled in a center program should be requested to wear identification stating they are diabetic. Medic Alert is an excellent form of identification. Also, as a remedy for possible unconsciousness due to hypoglycemia—low blood sugar or insulin shock—the diabetic should carry some form of quick sugar at all times. These two precautions protect both the client and the center. Diabetics should be encouraged to continue these practices at home.

Blood glucose/urine testing is essential for the diabetic. This is where a staff nurse would be helpful to perform this test before each meal and at bedtime. For some diabetics this might be the first time blood glucose has been checked regularly, and this would give them an idea of what type of control they are maintaining. Additionally, for those diabetics who are regularly checked at home, this service should be continued while at the rehabilitation center. Some professionals feel we are imposing our values on diabetic clients when we demand that urine/blood glucose be checked. I do not view this procedure as imposing values, but providing an environment for maintaining good health. Would a visually impaired person be allowed to travel outdoors without a cane while at the Center? The health risk is the same.

A diabetic who is not monitoring blood sugar/urine sugar levels has no idea what kind of control is being maintained. With the change in activity level while at the Center, insulin amount/diet may have to be altered. The only way to know how much is by testing. Many diabetics say to me "I know how my blood sugars are running by the way I feel." By the time the person starts to feel the effects of elevated blood sugar, the sugar level has been high for a while. Once blood sugar is elevated, it is much harder to bring it down. More importantly, the person runs the risk of going into acidosis (dehydration) and if untreated, diabetic coma, which is a life-threatening condition. On the other hand, running a consistently low blood sugar can impair judgment and impede the learning process.

An area where rehabilitation centers can really fall down in accommodating the diabetic is diet. The food that is often served in these institutions is not conducive to the diabetic diet and overall good control. Typically, the food is high in starch and sugar and low in fresh vegetable and fruit, lean protein sources and complex carbohydrate. A meal I was served at one such institution consisted of a large plate of spaghetti with meat sauce (very little meat and the sauce tasted sweet), garlic bread, a small salad, and cake. The meal was mostly starchy carbohydrate. A diabetic eating that meal would probably leave the table with an extremely elevated blood sugar. Rehabilitation centers must start serving more nutritious meals, which would be better for everyone. A diet rich in fresh or frozen vegetables (plain), complex carbohydrate such as whole grains and legumes, lean meats and fish and fruit is much better.

The rehabilitation teacher plays an important role in teaching the diabetic client good nutrition. Once a diet has been prescribed, the R.T. can review it with the client and go over what is included in the different exchange lists. The diet should be put in a form that is easily read by the client. Eventually the person should have the diet memorized. Reviewing portion sizes with tactile models is very helpful. For example, a three-ounce piece of chicken is about this big. The principles of preparing meals from scratch as opposed to relying on prepared foods is essential for the diabetic to maintain good control. (Many prepared/packaged foods contain high levels of sugar and salt.)

The R.T. also teaches the use of insulin measuring devices. This should be done in conjunction with a nurse to be sure the proper procedure is used. In my work as an itinerant rehabilitation teacher, I have observed many people, diabetics of long duration, incorrectly drawing up the insulin dose, particularly with a mixed dose.

In summary, if the rehabilitation center is addressing the areas of mobility, communications, personal hygiene, housekeeping, etc., is not management of health just as important? Actually, control of diabetes is necessary before anything else can be learned. The issue of striving for good control of diabetes is still debated by many physicians, so the confusion many diabetics have about their diabetes is understandable. However, more and more of the literature on diabetes points to the benefits of maintaining near normal blood glucose levels. People coming to the rehabilitation center have lost their eyesight; possibly, addressing the issue of good control can prevent further complications and prolong a more productive life.

Further Resources for Rehabilitation Teachers

Diabetes Teaching Guide
by George P. Kozak, M.D.
Boston: Joslin Diabetes Foundation, 1977.

Instructions for urine sugar testing, the diabetic diet, insulin use and administration techniques, symptoms of and remedies for hyperglycemia (high blood sugar) and hypoglycemia (low blood sugar), managing insulin and diet on sick days, etc. A revised edition planned for Fall 1982 will discuss home blood glucose monitoring. The text is written for newly diagnosed or recently hospitalized diabetics.

The Joslin Clinic
One Joslin Place
Boston, MA 02215
(617) 732-2539

Print.
Price: $4.00

Joslin Diabetes Manual, 11th Edition
Edited by L.P. Krall
Philadelphia: Lea and Febiger, 1978.

Information on diabetes including illustrations, charts, photographs.

Lea and Febiger
600 South Washington Square
Philadelphia, PA 19106
(215) 922-1330
and
The Joslin Clinic
One Joslin Place
Boston, MA 02215

Print.
Price: $8.50 (English)
$13.50 (Spanish)

or
G.K. Hall
70 Lincoln Street
Boston, MA 02111

Large Print.
Price: $24.75 (2 volumes)

Materials and Aids for the Visually Impaired Diabetic
Prepared by the National Diabetes Information Clearinghouse
July 1980

A bibliography of information on diabetes-related visual impairment, it lists 114 items in various media and includes devices with price and ordering information.

National Diabetes Information Clearinghouse
Box NDIC
Bethesda, MD 20205
(301) 496-7433
(202) 842-7630

Print.
Price: Free.

Special Devices and Equipment for the Visually Impaired Diabetic
Prepared by R. Keith Campbell
American Pharmacy
Washington, D.C.: American Pharmaceutical Association, 1981.

It evaluates some urine testing systems and magnifiers (as well as such technologically advanced aids as the Optacon).

Vision Foundation, Inc.
770 Centre Street
Newton, MA 02150
1-800-852-3029
1-617-965-5877

Cassette.
Price: $2.00

Teaching Guides for Diabetes Education Programs: Selected Annotations
Prepared by National Diabetes Information Clearinghouse
June 1979

A bibliography of materials which are instructional vs. simply informational, useful to health professionals in designing programs, or useful to patients and families as a study guide.

National Diabetes Information Clearinghouse
Box NDIC
Bethesda, MD 20205
(301) 496-7433
(202) 842-7630

Print.
Price: Free.

You, Your Eyes and Your Diabetes
by Donna L. Johnson
Winnetka, Illinois: The Hadley School for the Blind, 1981.

Written for the diabetic who is experiencing vision loss, the book provides information about the condition, diet, exercise, insulin management, and preventive medicine in diabetic control.

The Hadley School for the Blind
700 Elm Street
Winnetka, Illinois 60093
1-800-323-4238
1-800-942-4193 (Illinois residents)

Jumbo Braille.
Large Print.
Cassette.
Borrowed as part of correspondence course.

Views of a Blind Diabetic

by

Davide Marletta, M.Ed.

I have been a diabetic for the last 27 years, legally blind, eight, and totally blind, three of the last eight. Much to the amazement of sighted, nondiabetics, I often think and say that I would rather be blind than diabetic. I guess the main reason for this attitude on my part is that I know what to expect from my blindness and have many aids and appliances to choose from to help me perform activities in both my personal and professional life. However, there seems to be much that still has to be learned about diabetes; the future, although promising, is still not definite. More and more of the literature these days seems to indicate that proper control of diabetes either prevents or minimizes complications. However, there still seems to be some disagreement over just what good control entails. Attitudes sometimes seem to change so fast that it is often difficult to stay on top of things. I can recall many years ago that I was instructed to spill sugar in the urine before going to bed in order to avoid insulin reactions during the night. Today, the emphasis is to stay as much within the normal range of blood glucose as possible. Although I am trying to do this, and have felt better for it, I still come across other diabetics and health and rehabilitation professionals who maintain that it is not possible for an insulin dependent diabetic to achieve near normal blood glucose levels or that reactions are to be avoided. Personally, I think that reactions once in a while are not bad; it indicates to me that my body is making full use of all the food that I am eating. (Of course, if reactions persist, then I must make some adjustments in either insulin or diet.)

Since what we know about diabetes today is more than we knew years ago, I cannot take all the blame for my diabetic retinopathy. However, I must admit that there was a good amount of cheating on my part. I think I was trying not to have my diabetes run my life; unfortunately, this took place through totally denying its existence rather than attempting to maintain proper control. Even after going through four months at a rehabilitation center, and learning how to use devices for measuring insulin myself, I blamed the diabetes for everything. At one point I actually believed that while I needed insulin to live, its constant use was also killing me; I thought that I had about five years left to live. With an attitude like that, it is no wonder that I continued to cheat knowingly.

It was at this point that I met two great women. One was the woman I would eventually marry; the other was the diabetic teaching nurse at the local medical center. I remember my girlfriend saying that she was glad to help me with my diabetes, but that it was my condition and I would have to accept some responsibility for it. Then, through the nurse, I learned that I was not dying and could live a good life if I would just take care of myself. The prospect of perhaps losing the woman I loved was the incentive I needed to try and get my act together. Although I thought none of this control business would work, I decided to give it a try. Surprise of surprises—I felt better, got good reports from my doctor, had better dental checkups. I began to get control of my actions and therefore my life. Today, I am happily married, successfully employed, get good medical checkups, and, in the last year, have become a father for the first time.

I am still striving for that sometimes unreachable goal: always having a blood glucose of sixty to one hundred twenty. However, in striving for it, I feel well, remain healthy and, surprisingly enough, find I have more freedom. That is, by knowing my diet, the exchanges, and how my insulin works, I find that I can make the necessary adjustments in an effort to maintain optimum control.

Admittedly, I do find that my diabetes is pretty constant on my mind. Now that I take three shots a day, I find I am very conscious of the time, so that I might take my shot at the proper time. When I eat out, I constantly am trying to figure out all the exchanges for that meal; sometimes this means not always eating exactly what I want. How nice it would be to go to a restaurant sometime and just pig out!

And, unfortunately, the issue of blindness and diabetes is not always so positive. To be honest, blindness itself is negative, even though with a lot of effort and support, it can be used in a positive manner. In my mind, diabetes is *never* positive. I see it as a potentially destructive disease. While more evidence points to good control being the key, who can say what the findings will be ten or twenty years from now? As if being diabetic was not enough, being blind on top of it makes it virtually impossible to be completely independent. At present, there are no devices available allowing me to draw my own syringes since I use low dose syringes; I have found no way that I can monitor either urine or blood sugars myself. For these things, I absolutely have to depend upon sighted help; fortunately, my wife is willing to do this for me. The idea that continuing to have elevated blood sugars might lead to even more complications is very frightening, to say the least. Because adolescence is hard enough, I dread the possibility of our son becoming a diabetic and having to deal with growing up in that context.

But, most significantly, I continue to be mostly optimistic that I can obtain good control and maintain it for the rest of my life; in the meantime, I feel great and just wish that they would hurry up and cure diabetes.

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About Contributors to Issue No. 6 of AAR

Ruth B. Carr, R.N. is Head Nurse of the Eastern Blind Rehabilitation Center, Veterans Administration Medical Center, West Haven, Connecticut. Part of her work is to teach the use of insulin gauges, needle guides, and vial holder in self-management of diabetic control with vision loss.

Brian Collins of Toronto, Canada is a student of nutrition. As a consumer with diabetic retinopathy, he shared with us his personal experience and evaluations of self-management of diabetic control with vision loss.

Richard M. Connors, M.Ed. is Supervisor of Community Services at The Carroll Center for the Blind, Newton, Massachusetts. He oversees the teaching of orientation and mobility in the community and is concerned with diabetic care and the teaching of self-management of diabetic control in the field of blindness rehabilitation.

Donna L. Johnson, instructor at The Hadley School for the Blind in Illinois, is the author of *You, Your Eyes and Your Diabetes*, the central text in a correspondence course for persons with diabetes and vision loss.

David Marletta, M.Ed. works in blind services as a personal adjustment couselor at the Maine Center for the Blind. His interest in and knowledge of diabetic control with vision loss is both professional and personal.

Laura V. Marletta, M.Ed. is Supervisor of Rehabilitation Teachers at the Maine Center for the Blind. Her previous publications include contributions to the Newsletter of Rehabilitation Teachers of the Northeast Chapter of A.A.W.B.

Judith W. Oehler, R.N., Ed.D. holds the position of assistant professor in the School of Nursing at the University of Wisconsin at Milwaukee. Dr. Oehler is the author of articles on diabetes appearing in professional and medical journals; most recently Dr. Oehler has been involved in the formation of a new publication, the *Journal of Opthalmic Nursing and Technology.*

Alice Raftary, M.Ed., Supervisor of Teaching, Greater Detroit Society for the Blind, is the author of the widely read and used manual *Modifications on Insulin Techniques for the Visually Impaired or Blind Diabetic*, from which her article in this issue was excerpted, with her kind permission.

Joyce Schulz, R.N., known for her previous articles on diabetic control with vision loss in such publications as the *Journal for Visual Impairment and Nursing*, teaches diabetes maintenance to clients at the Minneapolis Society for the Blind.

Allene R. VanSon, R.N. is associated with the Erie County Medical Center in Buffalo, New York where she teaches the self-management of diabetic control; she is the author of *Helping the Blind Measure Insulin* and another valuable manual, *Stop! Look! Listen!*, which gives instructions for diabetic foot care.

AIDS AND APPLIANCES REVIEW

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770 Centre Street, Newton, MA 02158
(617) 969-6200

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Associate Editor: Marlene Gast

The Light Probe: A Versatile Aid

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PREFACE

Acknowledgments

Each issue of *Aids and Appliances Review* grows out of the experience, time, and efforts of many individuals. *AAR* would like to thank those persons who contributed invaluable assistance in preparing Issue No. 7. For their time, information, and inspiration, we thank Dr. Tom Benham and Mrs. Lee Benham of Science for the Blind, William A. Gerrey of Smith-Kettlewell Institute of Visual Sciences, and Jerry Kuns of Sensory Aids Foundation. In response to the editors' invitation, these individuals came together to engage in a lengthy conversation about the light probe's development and practical applications, which was taped at The Carroll Center for the Blind on April 30, 1982. Much of their information and commentary on the light probe serves as the background text in the otherwise unsigned portions of this issue. In addition, we also gratefully acknowledge the assistance of Alex H. Townsend, Consumer Resources Specialist at the American Foundation for the Blind; as with previous issues of *AAR,* Mr. Townsend shared with us material from his research files and helped us make contact with other knowledgeable persons in the field. One of these persons, C.W. Garland, Techical Officer, Royal National Institute for the Blind, in London, England, lent to us a sample of the RNIB light probe, sent air mail to meet our deadline. In addition, we would like to thank Rainer F.V. Witte of Deutsche Blindenstudienanstalt (German Institute for the Blind), who arranged for the loan of the Audilux light probe for our evaluation. To Dr. Emerson Foulke of the Perceptual Alternatives Laboratory at the University of Louisville we owe thanks not only for a detailed response to our initial questionnaire but also for putting us in touch with Dr. Barry Horowitz, author of principal articles in this issue. To Harvey Lauer, Research Specialist at the Veterans Administration Hospital in Hines, Illinois, we are indebted for a telephone interview and for his taped instructions on identifying paper currency using the light probe.

We are grateful to Forrest M. Mims, a contributing editor of *Computers & Electronics* (formerly *Popular Electronics),* for his spirited endorsement of permission to reprint his articles on the light probe. And, finally, we are grateful to Betty Amado of Ziff-Davis Publishing Company and to Harry Helms of McGraw-Hill for their time and efforts in arranging permission to reprint those articles which originally appeared in *Popular Electronics*.

Locally and nationally, there are still others in the field whose support, encouragement, and information continue to be an invaluable resource to us; we regret that we do not have space to thank them individually for their essential contributions.

Editors' Note

The detection of light is often fundamental to accomplishing both routine and complex tasks in occupational situations or in daily life. The buttons of a common multiline telephone illuminate to show when a line is in use; to obtain a free line, an unlighted button must be perceived aud pushed. The buttons of a vending machine light to indicate when it is out of a particular soft drink or candy bar to warn consumers not to drop in change for that item. Some smoke detectors have a small light which blinks every few seconds to indicate that they are operational. Numerous further examples of indicator lights in daily life include those announcing the "on" status of electric cookers, coffee pots, automatic beverage heaters, washing machines, dryers, and the stereo capability of an FM radio, to name only a few.

Detection of light and dark surfaces can also be fundamental to performing certain tasks, though this capability is less obvious. With sight one is hardly aware that many tasks of identification actually involve recognizing dark areas on light surfaces or vice versa. One such task, which is taken for granted with sight, is positioning letterhead stationery in a typewriter. Automatically, the darker print of the letterhead is properly recognized and rolled into the machine; there is no need even to read the print to know that it's the letterhead — the presence of a darker area on the lighter surface of the blank page triggers recognition and directs the typist to insert it properly. In typing, nonvisual techniques can manage other steps so that only a means of detecting the changes in surface coloration is needed to begin the task correctly. But, without a reliable means of identifying the correct side and position of the paper to be typed, disastrous results can occur for an otherwise accomplished blind typist.

The light probe can provide such a means to detect changes in surface coloration as well as to perceive the myriad indicator lights and other sources of illumination which can prove essential information in occupational or daily living settings. Small and simple electronic devices, light probes can audibly indicate the status of a light, the presence and source of illumination, or the relative darkness or lightness of a surface. As such, a light probe can provide invaluable assistance to persons with vision loss. Even a cursory survey of practical applications can demonstrate the utility of the light probe, which signals through sound essential information about light or surface variations in darkness or lightness.

Surprisingly, however, interest in the light probe as a sensory aid has not been widespread. Use of the light probe has tended to be confined to individuals who are professionally or personally oriented to the technical fields; these persons have known firsthand about the resource and have had opportunity to explore it fully. But, given the light probe's relatively low cost and high durability together with the multiplicity of practical applications and its relative technical simplicity, we feel that the device is potentially useful to a much wider range of persons with vision loss. With this issue we hope to establish wider acquaintance with the light probe, and we hope to stimulate further exploration and development of the light probe and its applications.

Robert McGillivray
Marlene Gast

The Light Probe: A Definition

"Light probes transform the energy of light into sound."[1] A. Wexler, who invented one version of the light probe, gives this definition. Though it can sound a bit magical, the light probe can actually be a simple electronic device, small enough to hold in the palm of the hand.

Most commercial light probes vary in size from that of a cigarette lighter to a bar of soap. Generally, this small device is activated by a switch much like a transistor radio. When the probe is activated, the small lens of the probe's detection area admits available light to the probe's inner circuitry which in turn produces a sound signal.

There are basically two modes of the light probe.

In the passive mode, the light probe detects light from an external source and audibly indicates the presence of this illumination and its intensity by clicking or buzzing in a frequency proportional to the light's intensity.

These light probes, which are commercially available, are described in the Resource Guide.

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[1] A. Wexler, *Experimental Science for the Blind: An Instruction Manual* (London: Royal National Institute for the Blind, 1972), p. 64.

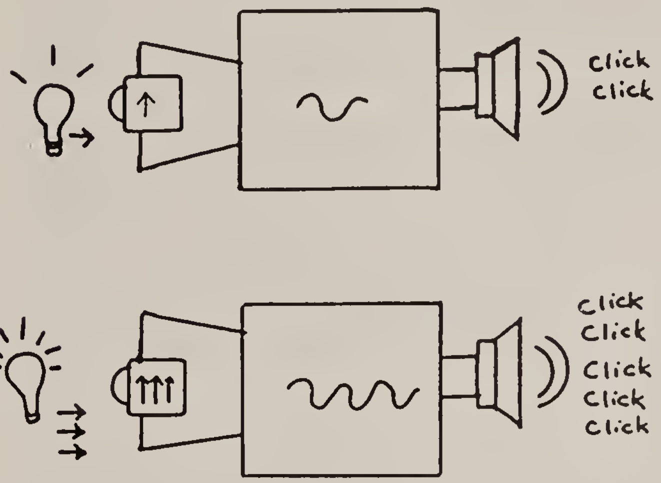
In the active mode, the light probe can audibly indicate the reflectivity of a surface with which it is in contact. It can indicate whether the surface is white and so reflects a great deal of light or whether it is dark and so reflects little light or none. To have the capabilities of the active mode, the circuitry of the light probe must contain an inner light source which emits light to the surface being scanned; other components of the active probe resemble those of the passive probe in that they collect the light reflected from the surface and transform it into sound that indicates the intensity of the reflected light. For light probes in the active mode, the technical term is the active retroreflective probe.

The Light Probe: A Basic Technical Description

The circuitry of a light probe puts to use the basic principles of electronic current flow. An understanding of the rudiments of an electrical circuit can enhance the reader's grasp of the Resource Guide, which follows. A more thorough explanation of the light probe's technical nature and properties is provided in the central section of this issue, Advanced Applications. Here we offer a brief overview of the light probe's technical nature.

An electrical circuit is by definition the path traversed by an electrical current, or, more concretely, a configuration of components which conduct, or pass on, an electrical charge. In an electrical circuit, the current flow through a resistor, one component of a circuit, is proportional to the voltage across it and the value of the resistor. The resistor is said to provide a value of resistance; and, as that value of resistance is lowered, more current is allowed to flow when voltage is constant. The resistor therefore determines the amount of electrical current which passes to other components of the circuit. For a light probe, the components of a circuit include a power source (usually a battery), a photoresistor within an oscillator circuit, and a sound source, often a speaker. Sometimes called a photocell, or the photodetector, the photoresistor is made of material that reacts to light by changing in respect to its chemical nature. When this chemical change occurs, the photoresistor changes also in the way it conducts electrical current within the circuit. When there is no light striking it, the photoresistor impedes the flow of current; but, when light strikes it, value of resistance is reduced in proportion to the amount of light falling on it so that the flow of current increases. Since the photoresistor is one component of the oscillator circuit, as the value of the photoresistor varies, the current within the circuit varies, and therefore the output of the oscillator varies.

The oscillator circuit converts the direct flow of current into fluctuating current, or pulses of current, in a frequency determined by the amount of current the resistor directs to it. This is what is meant by the output of the oscillator. Connected to the oscillator is the sound source. When the oscillator produces pulses of electricity in proportion to the changes in the photoresistor, those pulses produce through speaker or earphone sound in a frequency of clicks or pitch proportional to the intensity of light detected. In brief, light probes are designed so that the intensity of light "seen" by the probe's photoresistor is translated into sound which will vary as the level of light varies.



The greater the intensity of light, the greater the frequency of the oscillator which in turn generates a greater frequency of clicks or a higher pitched squeal.

Guide to Common Applications

A light probe can serve as an assistive device whenever a task requires knowing the status of a light or the darkness or lightness of a surface. For some brands of kitchen ranges, a tiny red bulb illuminates to indicate that the oven is on and goes off to indicate when the prescribed temperature has been reached for preheating. Likewise, a red light often indicates that stereo equipment is operational. Detecting indicator lights is only one example of how the ability to monitor lights — to know whether they are on, off, or blinking — is integral to the tasks of daily life. Examples of the part played by the ability to monitor lights are too numerous to list, but the point is clear: a light probe can detect these lights and so assist in the many tasks of independent living with vision loss.

The above applications are, of course, examples of how a passive light probe may be used; an active probe is used to detect the darkness or lightness of a surface. Because it measures reflectivity, an active probe can, in theory, indicate different shades of gray and therefore, in theory, the differences between some colors since different hues reflect distinct amounts of light. In practice, the active light probe can readily detect a strong contrast between dark and light surfaces such as a transition from white paper to black ink on letterhead stationery for positioning it correctly in the typewriter.

The Guide to Common Applications which follows is an effort to provide a closer look at some light probe uses reported by persons who have employed light probes as assistive devices over an extended period of time. For a succinct survey of applications review below the list of applications provided by the Smith-Kettlewell Institute Rehabilitation Engineering Center in *Annual Report of Progress, April 1978 — March 1979:*

Passive Mode

1. Detecting lights in a room.
2. Detecting lights on a telephone.
3. Detecting pilots on home appliances and electronic equipment.
4. Determining whether lights are blinking or steady.
5. Detecting fires in fireplaces and flames of candles.
6. Detecting elevator indicator lights on outside and inside panels.
7. Determining the relative brightness levels of LED's for classification in industry.
8. Determining the colors of lights via their relative intensities.

Active Mode

1. Determining reflectivity of a surface (gray scale).
2. Detecting print on a printed page, as for detecting a letterhead.
3. Locating typing to check the operation of a typewriter, including determining the length of the last word typed.
4. Locating a signature line for a letter or a check.
5. Reading meters by locating the reflective needle.
6. Determining stripes and checks on clothing as well as different reflectivity of material.
7. Determining the use of a cassette by comparing the sizes of the two spindle rolls.
8. Distinguishing between two familiar patterns.

Passive probes, which indicate the presence, absence, or intensity of illumination from external sources, can be used to detect reflectivity from a surface when the probe is held close to, but not against, the surface. It distinguishes only gross changes in shades of light and dark, and sound output will vary according to changes in distance between probe and surface and according to variations in the areas of ambient light. But active probes only can be relied upon to provide indications of fine distinctions in surface reflectivity. The following guide has in mind the use of the passive probe for detecting external light and the use of the active probe for detecting changes in surface reflectivity.

To Detect Room Lights

In photographic darkroom, a passive light probe may be used to make certain that the lights are *off* before the process of developing film or x-rays is begun.

Arriving home in the evening, a light probe user can at once discover whether house lights are on and, generally, whether the rest of the household is home. When the rest of the household has turned in early, a light probe user may detect which lights have been left on at night in order to extinguish them before retiring.

One light probe user comments on this use and travelling with a light probe: "If I'm at somebody's house as a guest, and I'm the last one up, invariably they go to bed and leave lights on, because I'm their guest. I have to figure out which lights are on and go and turn them off. I find that probably happens everytime I travel."

To Locate The Sun

On a cloudy day, a passive probe can detect the position of the sun in the overcast sky. However, a highly sensitive probe can "cut out" or become saturated with this high intensity light and will produce no sound.

To Detect A Hotel Message Light

Often, motel and hotel rooms are equipped with a light that is illuminated when messages have been left with the registration desk. Usually located either on the telephone itself or on the wall near the phone, the light may be detected if illuminated by a passive light probe. Thus the traveller avoids the bother of calling the desk unnecessarily to check for messages.

To Travel by Elevator

A light probe may be useful in two ways when travelling by elevator. The direction of an approaching elevator may be discovered by using the probe to indicate whether the up or down light is illuminated on the panel outside the elevator doors.

Inside the elevator, the light probe can signal when the elevator arrives at the desired floor. Since all elevator lights are neither in standard locations nor arrangements, nor are they all brailled or tactually identifiable, this use of the light probe works best in elevators familiar to the user. The user first locates the rows of buttons which light to indicate the floor desired and then he or she places the activated probe over the lighted button. When the elevator reaches that floor, the light goes off and the light probe becomes silent.

To Explore a Public Place

One long-term light probe user, who is occasionally a public lecturer, uses it to discover the location of light sources, including the out-of-doors and sometimes whether the lights are incandescent or flickering fluorescent lights. He likes to gather this information about his environment in order to determine how his presentation might be affected — since the lights will influence how sighted members of the audience can view him. He may choose to leave auditorium lights on or perhaps extinguish them leaving only the lectern lights on. He may have the auditorium dark for the showing of slides or a film while having himself spotlighted to emphasize his accompanying narrative. The passive light probe allows him to check out lights to monitor this kind of stage setting.

To Explore and Play

Persons long acquainted with the light probe have discovered some playful possibilities for its functions. Reportedly, in order to stire the fire, one user checks the intensity of the flames in his fireplace. A light probe can "watch" a candle flicker and might come in handy sitting around a table at a cocktail lounge. One man claims that he uses it to check out the amount of ambient light in order to plan his next move with his dinner partner. More celestial uses include watching a lunar eclipse and watching the setting of the sun into the Pacific ocean. A delighted light probe user reported to Science for the Blind that he had been able to count the freight cars of a long train for the first time since childhood. He took advantage of a passive probe's capabilities in detecting intermittent transmission of backlight as the spaces between cars passed in front of him and his probe.

To Monitor Laboratory Experiments

A passive light probe can monitor accurately a variety of phenomena and tasks related to conducting experiments or to undertaking scientific investigations in the laboratory. The motion of a pendulum, for example, can be detected by a passive probe mounted in the front of the pendulum with a light source behind the pendulum; each time the pendulum interrupts the path between sensor and light source, the sensor buzz will also be interrupted. On the same principle, a piece of rotating equipment may be monitored. Likewise, a light probe can assist in weighing on a balance scale. A known weight is placed in one pan of the scale while the unknown quantity is placed in the other; different known weights are tried until an exact balance of the two pans is achieved. A light probe can assist in this process by detecting the wiggling or stillness of the pointer which indicates when a balance has been achieved. When a light source is behind the scale, the wiggling of the pointer will interrupt the light rays, and the light probe will indicate the interruption by a lowering of pitch. When it is important to detect color change in a solution as an indication of titration point or some other significant characteristic, an active light probe can be used to signal a color change while a passive light probe can be used to signal a change in opacity.

To Monitor a CRT Screen

A passive probe can be used "to look" at the screen of a CRT on a computer terminal. It can be used to demonstrate that computer graphics exist or even to trace the lines in order to gather a sense of their presence and relationships one to another.

It can be useful when a speech output computer access device is being employed. Should the speech output be overrun by some aspect of main program, and is thus lost to the user, visual display remaining on the CRT could be detected to indicate that main program was still running. Such information would alert user to correct problem with speech output device.

To Evaluate Lights

For a blind rehabilitation engineer, a light probe can be useful in gathering information about a client's potential work site. If quality and direction of room light or lamps are important, the engineer can gather such information as whether the lights are incandescent or whether they are flickering flourescent light. Science for the Blind Products explains this application in product literature for their light sensors: "Incandescent lamps will provide an almost pure tone. Fluorescent lamps will cause a buzzing sound produced by the 60 Hz AC. The fluorescent light actually goes out between AC (common house current) pulses, while an incandescent lamp on AC remains constant because of the thermal inertia of the filament. A headlight or flashlight will provide a pure tone because it is DC. Daylight also produces a pure tone."

To Choose Clothing

An active light probe can be useful in choosing clothing — to tell light colors from dark. For example, a light probe could aid in the difficult task of tactually discriminating particular pairs of socks. Some light probe manuals suggest using it to distinguish clothing patterns — to tell checks from stripes, to detect plaids. While this fine discrimination of particular patterns of light and dark might not be possible for some users, most could tell plain from patterned clothing, generally, by using an active light probe.

To Monitor a Tape Cassette

An active light probe can be used to gauge the amount of tape remaining to be recorded when recording on some cassette tape recorders. With an active probe, the sensor is placed over the shallow window which centers the cassette and which reveals blank tape being unwound from the lefthand spool and wound recorded onto the righthand spool. The probe signal will change in pitch as the sensor tip is moved from a position over the spool of tape to the point over empty space between the two spools. That way it is possible to tell whether the left or right spool has more tape and to predict when almost all the tape is recorded and therefore wound on the righthand spool of the cassette, at least in theory.

The only kind of active probe that should be used is one having the sensor tip on an umbilical cable, that is, at the end of a relatively long cord that attaches at the other end to the box which contains the speaker. Otherwise, if the sensor and speaker are in the same unit, then the electromagnetic signals in the speaker could actually magnetize the tape, will in fact record on the tape. The probe's speaker must be a fair distance away from the tape recorder for this application to prove successful. This technique works best when it is possible to get the light probe onto the cassette itself while it is in the machine; thus tape recorders that have removable lids or whose tape compartment lid can be open while the recording is happening.

To Monitor Aspects of Typing

An active light probe, which can signal the change from light to dark surfaces, can aid the typist. Because it can signal print or blank paper, the light probe can distinguish blank paper from printed, can indicate the letterhead on stationery for positioning it properly in the typewriter. The signature line may be located when the letter is ready to be signed. The righthand margin is distinguishable from the left on typed letters, since the left is even while the right (unless justified) is irregular. During typing, the last word typed may be exactly located for erasure and correction should an error be suspected. An active light probe can tell whether the ribbon is set for type or stencil since it can distinguish print from blank paper. Science for the Blind has an end-of-ribbon-indicator.

To Reference Lines on Graph

A rehabilitation engineer has suggested an active light probe for the use of a visually impaired employee in monitoring the graphs produced by a computer-controlled color analyzer. The graphs are drawn automatically on graph paper through an x-y system which has a three-color pen attached to it. The main task involves placing a color test photograph in the analyzer and inputing the computer which produces the first graph. The second graph is produced by changing the color of the pen and giving a different input to the computer which then produces the second graph. The same procedure applies for the third graph.

The major question of the employer concerned was how the visually impaired operator would know that the graphs were produced and that ink had, in fact, flowed from the three-color pen; the operator only had to be certain of this information, since he did *not* have to interpret the graph. The solution to the problem was to use an active light probe to detect that three, separate, dark display lines were produced. If one or more were missing, the pen could be changed or other corrective measures taken. The next concern would be in initial setup of the equipment.

In initial calibration, the operator must set a zero line when there is no output from the analyzer. This can be judged to be correctly set when the pen marking and the baseline of the graph paper coincide and together make only one distinctly dark line. The active light probe will indicate the one dark line that occurs thus when the initial calibration is set correctly.

RESOURCE GUIDE

Introduction

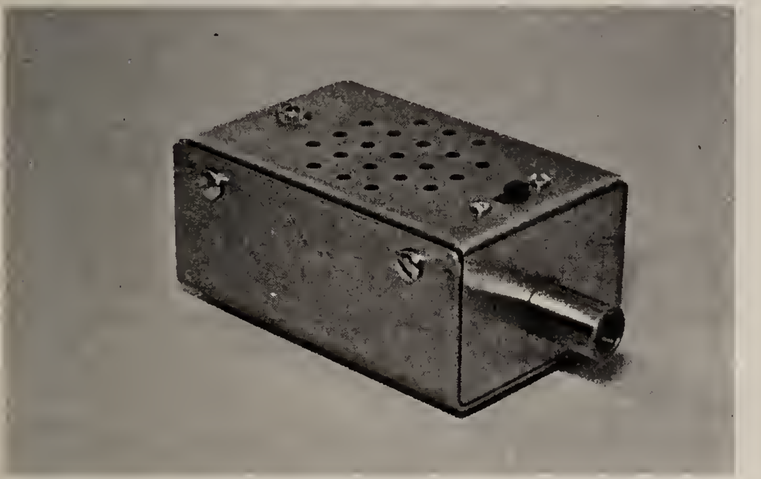
When considering light probes, it is important to know that individual brands and models of commercial light probes may have passive capabilities only, or they may combine the two modes in one unit. In addition, light probes vary not only in respect to type but also in respect to other characteristics. External characteristics such as material and shape of case or size and weight differ among brands and models, a significant factor depending on the circumstances of intended use. Available in commercial probes for particular applications are various other features: volume controls for varying sound output and jacks for such attachments as earphones and probes for detecting phenomena other than light. The particular technical nature of any light sensor is a matter of its specific components, its sensitivity, and its parameters which vary among brands and models; the particular technical nature can influence where and how the probe may be used. The following Resource Guide is intended to provide much of the above particular detail for specific light probes.

When selecting a particular brand or model of light probe for purchase, the particular features of specific brands and models should be considered in terms of the task to be accomplished. One feature that can affect how the light probe may be used is the detection area. The shape and size of the detection area can determine the amount of illumination that reaches the photocell serving as light sensor; effects of a cylindrical tube for the detection are discussed by B.R. Horowitz in "An Introduction to Light Probes: Some Properties and Uses," on page 15 of this issue. The physical design of the light probe is another feature which is important as it relates to potential applications. For an example, consider how a basic passive light probe, housed in a lightweight, square case fitted with an earphone jack and an attached earphone, suits the particular requirements of a telephone receptionist/typist working in close proximity to his or her colleagues. The squareness of the case makes the probe stable and therefore easy to locate between uses. The lightness makes it portable, easy to carry for uses at home, and the earphone prevents the buzz from annoying neighboring colleagues. This is only one instance of how a light probe's particular features can fit a complex set of user and situation requirements. The Guide to Common Applications, which precedes the Resource Guide, can suggest other occupational and daily living situations in which the light probe can prove useful. The Resource Guide itself contains some information directly relevant to applications, common and advanced, and the article, "Some Applications of Light Probes in the Chemistry Laboratory: A Status Report," on page 18 provides a detailed look at the light probe's capabilities when the greatest demands for discrimination are placed upon it. When selecting a light probe, the user's personal requirements together with the demands of the occupational task or other setting of use dictate the most appropriate guidelines for a particular choice.

Many of the commercially available light probes will allow simple modifications for specific activities or needs, and some manufacturers will modify the device upon request before delivery. Or individual users with some technical background may wish to modify a particular light probe after delivery. In either case, earphones may be added, switches may be added or changed, a tube may be devised for the detection area, or length of existing tube may be modified, or the housing of the entire circuitry may be modified to suit the needs of individual users and applications. One notable example is provided by Sensory Aids Foundation. For a blind receptionist who uses the probe to detect lighted phone buttons which in turn must be pushed, the light probe's circuitry can be mounted on a ring-type guitar pick which may be placed on the working hand at the end of a finger. Then the light may be detected and the button pushed, all in one efficient motion. A careful analysis of the task, imagination, and some technical know-how are the only requirements for simple but effective modifications of these essentially uncomplicated devices.

The Resource Guide which follows provides product and ordering information based on 1982 literature or queries to the manufacturers and distributors. Descriptions and evaluations were derived from surveys of knowledgeable light probe users and from investigations of actual probes obtained by the AAR Editors with the financial support of a grant from the National Institute of Handicapped Research.

APH Light Probe



Source for the APH Light Probe

American Printing House for the Blind
1839 Frankfort Avenue
P.O. Box 6085
Louisville, KY 40206

Cost: $22.00
Catalog No. 1-0850

Type: *Passive.*

Prove can indicate presence, absence, or intensity of light from external sources.

Function by Design: *Specific Application — Educational.*

Designed for use in classroom settings by young blind and visually handicapped students investigating phenomena of light and exploring other highly visual concepts in laboratory science.

Detection Area: *Hollow Tube Mounted Permanently.*

Light sensor is housed in probe unit at the base of the hollow tube mounted on exterior; the tube directs light rays to the sensor. See Horowitz: "An Introduction to Light Probes: Some Properties and Uses," Figure 4.

Switch: *On-Off.*

The plastic slide switch on the top surface activates probe. No volume or sensitivity controls.

Sound Output: *Built-in. Jack for Earphone.*

Built-in speaker has loud output. With earphone cable plugged into jack, sound is through earphone only.

Power: *Battery Operated.*

Uses a 9-volt transistor battery, commonly available. Four screws must be removed to open unit for battery replacement.

Physical Design: *Heavy and Durable.*

Basic circuitry is contained in a rectangular, brushed stainless steel case weighing 375 grams. It measures 3-½" x 2-3/8" x 1-½". The sensor is located at the base of the permanently affixed sensor tube which extends approximately 1 inch from the unit. Four rubber feet provide stability. The top surface features perforations for sound outlet, the slide switch, and a jack for any earphone cable.

Accessories: *None.*

Considerations for Use:

Rugged physical construction for long-term classroom use.

Extended sensor tube serves as tactual cue to the student in directing the light sensor toward a light source.

Sound is very loud. Can be uncomfortable with use of earphones. No volume control.

Manual: *APH LIGHT SENSOR MANUAL, by Frank L. Franks and LaRhea Sanford, 1976.* In print.

Designed for educators, the manual contains step-by-step instructions for 25 experiments to teach concepts of light intensity and other highly visual concepts. The Table of Contents lists the concepts demonstrated through use of the light probe:

CONCEPT 1 — Brightness (intensity) of light.
The sound from a light sensor changes as the amount of light from the light source changes.

CONCEPT 2 — Light and dark shades of clothing.
Light and dark shades of clothing can be detected using the light sensor.

CONCEPT 3 — Shadows on a screen.
Shadows appear when objects are placed between a light source and a screen.

CONCEPT 4 — Large and small shadows.
The size of a shadow on a screen can be changed by moving an object closer to or farther from a light source.

CONCEPT 5 — Heat Expansion.
The liquid in a thermometer expands when heated.

CONCEPT 6 — Contraction.
The liquid in a thermometer contracts when cooled.

CONCEPT 7 — Sunlight on the earth.
The sun shines light on only one-half of the earth at a time.

CONCEPT 8 — Darkness on the earth.
The earth blocks the sunlight and makes a shadow which causes darkness on one side of the earth.

CONCEPT 9 — Rotation of the earth.
The rotation of the earth causes an increase in the amount of light in the morning and a decrease in the amount of light in the evening.

CONCEPT 10 — Oxygen.
Fire needs air (oxygen) to burn.

CONCEPT 11 — Carbon dioxide.
Carbon dioxide can extinguish a fire.

CONCEPT 12 — Contents of a container.
The amount of material inside a container can be determined by using a light sensor.

CONCEPT 13 — Evaporation.
Water can go into the air or evaporate.

CONCEPT 14 — Transparency of water.
Water is clear or transparent.

CONCEPT 15 — Semitransparency.
Milk is semitransparent.

CONCEPT 16 — Opacity.
Dirt is opaque.

CONCEPT 17 — Water pollution.
Pollutants mixed with water reduce the transparency (or clearness) of the water.

CONCEPT 18 — Water pollution.
Some pollutants float and some sink to the bottom of a jar when mixed with water.

CONCEPT 19 — Sediment (dirt) in water.
Dirt sinks to the bottom of a jar when mixed with water.

CONCEPT 20 — Purification of water.
Water can be purified by filtration.

CONCEPT 21 — Liquid displacement.
A solid object displaces water.

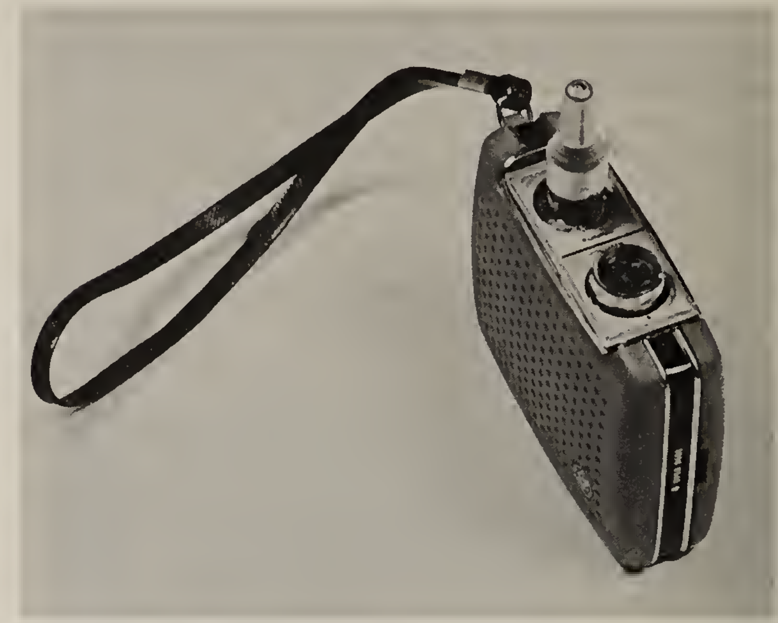
CONCEPT 22 — Breaking up a molecule.
Some molecules can be broken up by heat.

CONCEPT 23 — Acids and bases.
Litmus paper changes color when placed in acids and bases.

CONCEPT 24 — A test for starch.
A food contains starch if a blue-black color appears after the application of a few drops of iodine solution.

CONCEPT 25 — Photosynthesis.
Although the first food to be made by green plants is glucose some of it soon changes to starch, which can be detected by iodine solution.

Audilux



Source for the Audilux
Deutsche Blindenstudienanstalt
Am Schlag 8, D - 3550 Marburg
Federal Republic of Germany

Cost: DM 167, - -
Shipping: DM 22, 60
(Parcel Post Air Mail)

Type: *Passive or Active.*

Can operate in either passive or active mode. With main switch on, probe is in passive mode and indicates status of external light. In addition, a small switch on the probe's nozzle can activate an inner light source to make the probe active. The light source in active mode is an incandescent micro-lamp.

Function by Design: *Multipurpose/Versatile.*

Equipped to accept accessories for various specific tasks — designed for use as both passive and active probe.

Detection Area: *Nozzle with Open and Rounded Point.*

The light sensor nozzle plugs into the square unit which contains sound source and other components of circuitry. The nozzle operates as a tube to collect light and provides a discrete area for use in the active mode when direct and point-specific contact is to be made with a surface. The nozzle is made of aluminum.

Switches: *1) On-Off for Probe Unit; 2) On-Off for Active Mode.*

1) A knurled thumb-wheel on one long, narrow face of the basic probe unit renders it operational in the passive mode.

2) On the light sensor nozzle is a tiny wheel which, when turned clockwise fully, will activate the inner light source rendering the probe operational in the active mode while main switch is on. If this small wheel is turned less than a quarter turn, the internal lamp lights only when the wheel is pressed like a push-button and held in; upon release of the small wheel, the light

extinguishes so that the active mode can be only momentary as needed.

Sound Output: *Built-in speaker. Jack for Earphone.*
No volume control. One surface of probe is perforated to release sound from speaker.

Power: *Battery Operated.*
Two AA-cells. Manual provides directions for replacing. Case is opened by means of leverage from a small coin or screwdriver inserted in slot provided.

Phsyical Design: *Lightweight and Compact.*
Basic circuitry is entirely contained in contoured vinyl case, 3" x 2-½" x 1", being originally a miniature transistor radio case. The light sensor nozzle plugs into a five-pronged jack which can also receive a series of other accessories. The five-pronged jack is located on the long, narrow panel above the main switch. The jack for the earphone is located on the opposite panel. A plastic loop attaches to one corner of the case for carrying or hanging the probe between uses.

Accessories: *Available.*
The Basic Unit L2 comes with the Combi-Light Probe F2, described above as light sensor nozzle. Other accessories for determining liquid levels and electronic component characteristics and tape recording levels are available. Accessories directly usuable for detecting light are the K1 Jumper Cable (No. 12 1006) for providing a flexible connection between light sensor and the basic unit and the Earphones, No. 12 1008.

Considerations for Use:

Active as well as passive capabilities.

Incandescent micro-lamp draws more current than an infrared source would require.

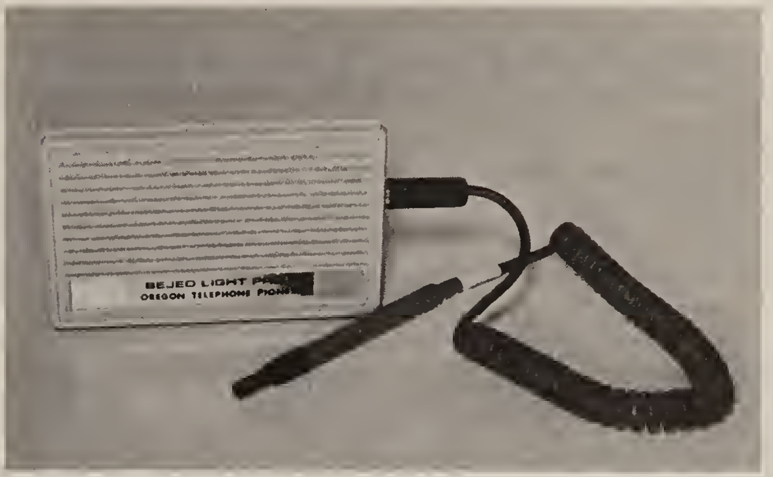
Momentary light source capability reduces excessive drain of current.

Availability of accessories for other specific tasks such as testing electronic equipment and detecting liquid levels.

In use as an active probe, handling of the unit may feel awkward.

Manual: *"Audilux: ein vielseitiger Helfer," in the German language, in print.*
Provides thorough instructions for basic applications in the passive and active modes. English translation available upon request from Aids and Appliances Review Editorial Office, The Carroll Center for the Blind.

Bejed Pioneer Light Probe



Sources for Bejed Pioneer Light Probe

Light Probe
Oregon Chapter #31
Telephone Pioneers of America
421 S.W. Oak Street, Room 114
Portland, Oregon 97204
Telephone: (503) 242-8326

Cost: $22.50*
Basic Amplifier Unit,
Battery Operated

Cost: $27.50
Basic Amplifier Unit,
with 120-volt Adaptor

*Price does not include light sensor on cable — see Accessories in this section to order separately.

Arkansas Enterprises for the Blind, Inc.
2811 Fair Park Boulevard
Little Rock, Arkansas 72204
Telephone: (501) 664-7100

Cost: $30.00,
Basic Amplifier Unit
with light sensor
on cable —
straight wire, not coil.

Type: *Passive.*
The probe indicates the presence, absence, or intensity of light from an external source.

Function by Design: *Specific Application — Multiline Telephone/Telephone Switchboard Lights*

Designed to detect the illumination of buttons on a multiline telephone or the activated lights on a telephone switchboard so that user may know the status of lines: incoming call, line in use, call on hold, or line free.

Detection Area: *Hollow Tube on Cable.*

The sensor is contained in a narrow tube attached to a flexible cable which plugs into the basic amplifier unit. The open end of the tube receives light while the other end provides the conduit for the cable which transmits the sensor's response to the amplifier unit where it is transformed into sound. There are two choices of sensor cable: coil cord or straight wire.

Switch: *On-Off/Volume Control.*

Similar to controls on many transistor radios, the plastic on-off/volume control switch is a thumb wheel mounted inside the box of the basic amplifier unit. A window in the housing allows access to the wheel switch. When wheel is moved from or to "off" position, a click is produced.

Sound Output: *Built-in. Jack for Earphone.*

The sound source is a built-in speaker connected to an amplifier with variable volume capabilities. Main amplifier unit is fitted with jack to receive earplug cable; when earplug cable is plugged in, sound output is through earplug only.

Power: *Battery Operated or 120-volt Current Operated.*

The basic amplifier unit is available in a choice of two models.

The battery operated unit uses a 9-volt transistor battery, widely available. To replace batteries, back cover is removed by inserting and twisting a coin in the slot provided on cover's edge.

The 120-volt current model adapts house current to the device and is equipped with a nine-foot cord for plugging into wall outlet.

Physical Design: *Lightweight and Portable.*

Housed within a Radio Shack mini-amplifier, the basic light probe circuit has been added to the amplifier circuit. The plastic case measures 4" x 2-½" x 1-½". The case has two jacks: the sensor jack (input jack) and an output jack for earphones; jacks are located on the same panel as switch.

Accessories: *Available.*

Accessories are available to enhance the specific function of monitoring the status of telephone/switchboard indicator lights, as follows, from Oregon Chapter #31 of Telephone Pioneers given at the beginning of this section:

Straight Wire Detector Unit (Light Sensor)	$2.50
Coil Cord Detector Unit (Light Sensor)	$5.00
Earphone	$3.50
Plantronic Headset Adaptor	$2.00
9-volt Battery	$.75

Considerations for Use:

Size and shape of device make it stable for use at desk.

AC adapted model eliminates need for costly batteries and prevents possibility of battery failure in the middle of a work shift.

Some users of the straight-wire-type have found that the wires connected to the sensor may tend to break after extended use.

For use as detector of telephone lights, unit is usually "on" for long periods of time, a state which diminishes the life of batteries in battery-powered unit.

Probe is designed to be used in direct contact with illuminated phone buttons; therefore range of sensitivity is narrow and cannot be depended upon to detect ambient light unless modified. Tube length can be shortened or entirely eliminated by cutting to allow more ambient light to reach sensor, if desired.

When probe is desired for use only with lights of multiline switchboard or telephone, then sensitivity should be kept low and can be lowered, if need be, as suggested by instructions from Oregon Chapter #31 of the Telephone Pioneers of America:

1. Ambient (normal) room light, if exceptionally bright, may cause the unit to "percolate" even though not pointed directly at a specific light source, such as a window, overhead or telephone indicator light.

2. Overloading — if the light to be detected, such as the telephone or telephone console buttons, is unusually bright, the unit may stop or "cut-out" when the sensor is placed directly against the button. This condition can be identified by slowly increasing the distance of the sensor from the light source until the unit once again starts to buzz. This also indicates over- sensitivity of the photo-cell.

Both of these conditions can be corrected by use of a foam filter. Cut a small piece of foam (supplied routinely by Oregon Chapter #1 when probe is ordered from them) just the size to fit into the sensor tube. Using the end of a paper clip, tuck this tiny square into the open end of the sensor, tapping it gently in as far as it will go. This diminishes the intensity of the light that can reach the photocell.

Manual: *Sheets of Product Literature Provided. In print.*

Some applications are suggested as the use of the probe on the multiline telephone or switchboard is expanded on in detail. Different tones produced by the probe are described and interpreted for telephone answering use on a multiline phone: "slow, interrupted tone indicates incoming call; a fast interrupted tone, a call on hold; a steady tone, line in use and no tone, a vacant line.

RNIB Audible Photoconductive Light Probe

Source for RNIB Audible Photoconductive Light Probe

Royal National Institute for the Blind
224 Great Portland Street
London W1N 6AA

Cost: L 16.80
Catalogue No. 9432

Payment should be made by International Money Order or Bankers Draft, payable in the United Kingdom.

Type: *Passive.*

Technically, the circuitry of the RNIB light probe produces a sensor in the passive mode, since it has no internal light source. It detects light from external sources and transforms the light into sound.

However, because of the unique construction of the detection area, the RNIB light probe can be used to detect the reflectivity of a surface, to indicate light or dark areas as described below.

Function by Design: *Multipurpose.*

Detection Area: *Conical Nosepiece with Translucent Tip.*

The translucent tip of conical nosepiece acts as lens to collect illumination from external sources or to gather reflection from opaque surfaces. When in contact with the surface being scanned for reflectivity, the translucent tip keeps the probe at a constant distance required for accurate discrimination of sound output, and the translucent characteristic prevents the probe from blocking the reflection. Thus, although the probe has no internal light source to produce reflection from a surface, the physical design allows it to detect the surface reflection of ambient light.

Switch: *On-Off.*

The rotary switch activates or deactivates probe. It does not control volume or sensitivity. Like the eraser of a pencil, it is located at the end of the probe opposite the detection tip. Slight resistance is felt when the switch is turned on or off.

Sound Output: *Built-in.*

Sound outlet holes are located on the body of the probe.

Power: *Battery Operated.*

Manual states that probe uses Eveready type D.23; sample probe contained in alkaline 1.5-volt size N battery.

Physical Design: *Lightweight, Compact, Cylindrical.*

The probe circuitry is entirely housed in a stainless steel cylinder resembling a fat fountain pen. It is approximately 4" long and ½" in diameter. The conical nosepiece is made of sturdy plastic.

Accessory: *Lenshood.*

A unique feature of the RNIB light probe is the plastic lenshood, a standard accessory. It is a plastic clip-on cone with open tip to allow entry of light. For general use, this lenshood is removed, but, the manual explains, the lenshood is beneficial when side lighting should be excluded for particular applications. "A typical application with the hood in position is the determination of the level of a liquid in a cup or open container. To do this point the probe, switched on, downwards and listen for the change in note caused by the liquid covering the tip of the lenshood which of course reduces the input of light. The lenshood should be dried after any immersion in liquid." The manual suggests another application for which the lenshood is useful: "The level of a liquid in a glass or transparent container can be determined by holding the probe horizontally with lenshood on and the point touching the side of the container and by moving it up and down."

Considerations for Use:

When using the probe, take care not to cover completely the two sound outlet holes.

Some users have commented that the cylindrical shape of the probe can cause the probe to roll away when placed on flat surfaces between uses.

Manual: *"Audible Photoconductive Light Probe" supplied by Royal National Institute for the Blind in print and braille.*

Manual routinely accompanies orders. Provides orientation to the device together with detailed suggestions for use and instructions for changing battery.

San Franciso Lighthouse Light Probe

Source for San Francisco Light Probe

San Francisco Lighthouse for the Blind Store
1155 Mission Street
San Francisco, California 94103
Telephone: (415) 431-1481 Cost: $40.00

Type: *Passive/Active.*

This probe can operate in either passive or active mode depending on the distance it is held from an opaque surface. When the probe is further than ½" from surface, it operates in the passive mode reacting only to an external light source.

When the probe is held within ½" from a surface or is placed against an opaque surface, the detector reacts to the light from the probe's built-in light source as it reflects from the surface being scanned. This is its active mode.

Function by Design: *Multipurpose.*

Designed to indicate the status of lights in a wide range of intensities and to detect surface changes from light to dark. For occupational or daily living applications, consult Guide to Common Applications in this issue.

Detection Area: *Concave Surface.*

The detector is Spectronics PX1404 reflective sensor assembly (a module) and exists on the top surface of the probe. A 1/4" x 1/8" concave surface, this detection area holds two tiny lenses; their positions at either end of the concavity cause them to be angled toward one another. Behind one lens is the phototransistor; behind the second lens is the light emitting diode whose reflection is sensed by the phototransistor when the probe is in contact with a surface.

Switch: *On-Off/Variable Sensitivity Control.*

A thumb-wheel switch, it is metal and knurled and fitted with a screw to mark various positions tactually. It produces a click when probe is turned on. The switch does not adjust volume. Rather, it increases sensitivity as it is turned forward clockwise. As sensitivity is increased, pitch becomes greater. At highest sensitivities the probe produces a squeal.

Sound Output: *Built-in.*

One perforation in the packaging of the probe, opposite the switch, emits sound from the build-in loudspeaker.

Power: *Battery Operated.*

The 9-volt transistor battery is widely available.

Physical Design: *Lightweight and Compact.*

The entire unit is hand-held. The circuitry is mounted on a battery terminal plate measuring approximately 1" x ½". The circuitry extends upward 1" only. The battery terminal plate with circuitry mounted on top clips into the terminals of a 9-volt battery to create the whole unit.

Vinyl sheathes the circuitry leaving the concave detection area exposed on the top surface. A soft leather pouch is provided as a carrying case; its top flap is punched with a circle to expose the detection area for the light sensor.

Accessories: *None.*

Considerations for Use:

Active as well as passive.

Probe is durable yet compact.

Easily portable to different settings because of size, weight, and self-contained components.

Variable sensitivity control permits choice of ranges of light levels to which the probe is to react. Turned to a lower sensitivity, the probe will respond only to high levels of illumination. Turned to highest sensitivity, the probe will respond to lower levels of illumination.

Probe will respond quickly to changes in illumination or reflectivity.

The probe may be left "on" accidentally to drain battery, since at low sensitivities the probe will respond only to highest levels of light and will remain silent even though activated.

Sound signal can be difficult for the hard-of-hearing to detect, especially in noisy environments.

If sound is conspicuous in public settings, place thumb over sound source — perforation opposite switch — to reduce the volume manually.

When used by persons with limited experience in applications involving fine discrimination of surface contrasts, the probe may prove difficult to guide; because of the sensor's concave detection area, the probe tends to wiggle against the surface being scanned.

The technique of currency identification by using the probe in its active mode is explained in the tape recorded directions of Harvy Lauer, Blind Rehabilitation Specialist at the Veterans Administration Hospital in Hines, Illinois. A copy of the tape may be obtained upon request by sending a blank C-90 tape cassette to Mr. Lauer at the following address:

Veterans Administration Hospital
117A Blind Rehabilitation Center
5th and Roosevelt
Hines, Illinois 60141

A copy of Mr. Lauer's tape may also be obtained upon request by sending a blank C-90 tape cassette to the AAR Editorial Office.

For deaf and hard-of-hearing persons, a vibrotactile light probe designed and packaged like the auditory version has been developed by Smith-Kettlewell Institute of Visual Sciences. Further information is available from the following address:

Rehabilitation Engineering Center
2232 Webster Street
San Francisco, California 94115

Manual: *"Light Probe: Instruction Manual and Suggested Uses," compiled by David W. Nelson, Smith-Kettlewell Institute, March 1979. In print.*

Published by the San Francisco Lighthouse for the Blind, the "Instruction Manual" provides guidelines for becoming familiar with the probe's capabilities and potential applications — room and indicator light detection; pattern detection and/or discrimination; print or line location on paper, etc. Instructions for changing the battery are given, and a sheet of paper printed with a gray scale is provided to enable the user to become familiar with the unit's sensitivity range. Manual routinely accompanies probe.

SFB Audicator Light Sensors

Basic Audicator unit is pictured with two sensors available for attachment.

Source for the SFB Audicator Light Sensors

Science for the Blind Products
(Wayne) Box A
Southeastern, Pennsylvania 19399
Telephone: (215) 687-3731

Type: *Passive, Active, or Passive and Active.*

The basic Audicator unit is an oscillator circuit and sound source which accepts attachments and modifications designed by SFB for specific tasks of light detection. Depending on the model of Audicator or on the accessory attached, the Audicator can operate in either light probe mode, or both, or can detect other phenomena such as liquid levels or value of electrical components.

Function by Design: *Multipurpose/Adaptable.*

Sound Output: *Built-in.*

No volume control. Sound is emitted through perforations in top of main unit by built-in speaker. Volume control and earphone jack are available as accessories.

Power: *Battery Operated.*

Basic Audicator unit is battery operated and requires an 8.4-volt mercury battery. A standard 9-volt battery is too large for the compact Audicator case. The 8.4-volt mercury battery in the Mallory brand fits best.

To replace battery, bottom plate of unit must be removed by first removing 4 phillips-head screws which thread through the device's four rubber feet.

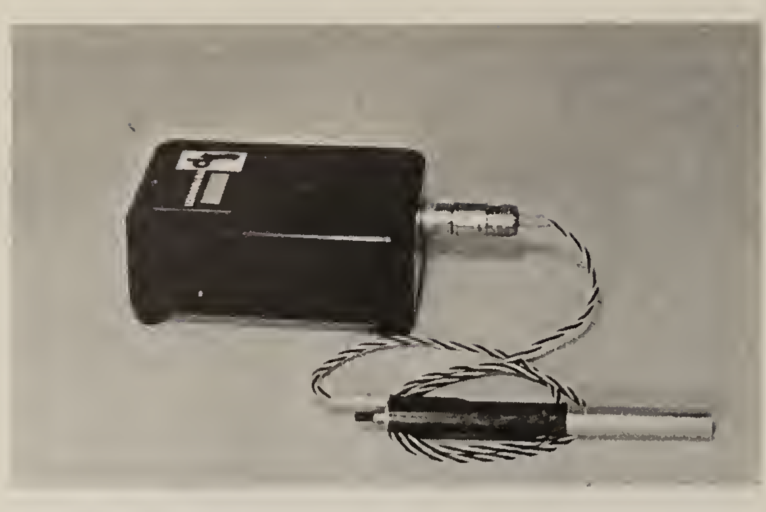
All Audicator light sensor models are available in 110-volt adapted models at a basic cost of $70.

Physical Design: *Lightweight and Durable.*

The basic Audicator exists in a black, molded plastic chassis measuring approximately 3¼" x 2" x 1". A metal plate forms the bottom of the box which contains basic oscillator circuit and sound source. The plate is attached by four phillips-head screws threaded through the four rubber feet of the device. A phono jack extends from one end of the chassis and accepts the various accessories. The top of the chassis is perforated to emit sound from built-in sound source.

MODEL: AUDICATOR (with One Accessory).

Basic Audicator unit is pictured with Plug-in Light Sensor attached.



Basic Audicator unit is pictured with Light Sensor with Switch on a cable attached.

*Cost: $50.00
Catalogue No. T-1

*The $50.00 includes choice of either the Plug-in Light Sensor or the Light Sensor with Switch on a Cable.

Type: *Passive.*

With either of two attachable light sensors available with this model, the probe indicates presence, absence, or intensity of light from an external source.

Function by Design: *Adaptable.*

Detection Area and Switch: *Varies with Attachable Light Sensors.*

Plug-in Light Sensor – Tube 1/8" in length directs light to photocell. The tube is formed by the recession of the photocell 1/8" inside a cylindrical plug which itself measures approximately 1 inch. The light sensor, thus housed in plug, is activated by pressing the plug firmly into a jack on the exterior of the Audicator. The Plug-in Light Sensor is silenced by removing it completely from the jack.

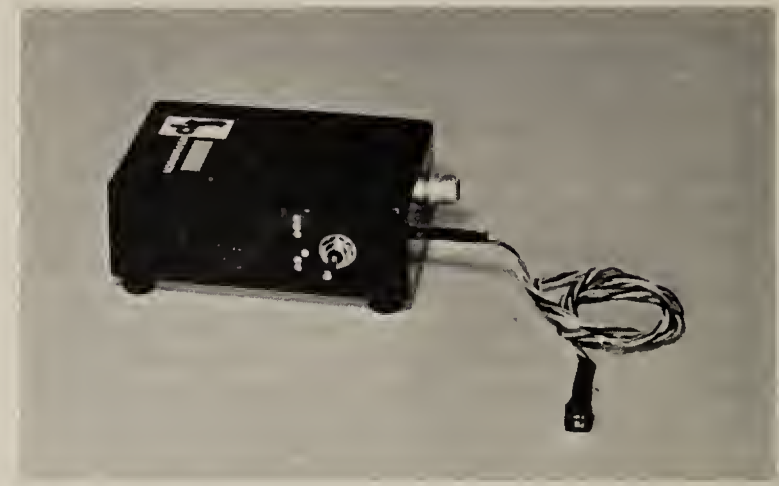
Cost: $10.00
Catalogue No. T - 1AP

Light Sensor with Switch on a Cable – Tube directs light to photocell mounted 1/8" inside a cylinder which measures approximately 3-½" in length; 18" (or longer, if requested) flexible cable attaches to detection cylinder and transmits impulses to speaker in Audicator. Cable has plug at opposite end which is accepted by socket.

Switch exists at end of sensor cylinder opposite open end; light sensor is activated by pressing switch and is only activated during time when switch is held in.

Cost: $15.00
Catalog No.: T - 1AS

MODEL: REFLECTICATOR (Audicator B/W)



The original Reflecticator consists of the basic Audicator unit with the black/white detector wired into it.

Cost: $70.00
Catalogue No. T - 1BW

Type: *Passive or Active.*

The Reflecticator model can be switched between either mode.

Function by Design: *Multipurpose/Adaptable.*

The Reflecticator is designed to provide active as well as passive capabilities within one unit. External jack will accept attachable light sensors as well as accessories for other applications.

Detection Area: *Sensor on Cable.*

Sensor unit contains both a photocell for detecting light and a light source for creating reflection from surfaces when the probe is switched to active mode. Photocell and internal light source are housed in a 1/8" rubber square at the end of an 18" flexible cable which is wired at opposite end into a basic Audicator unit.

Newer models of the Reflecticator are available with sensor on a plug-in cable. Choice of wire-in or plug-in sensor should be specified when order is placed.

Switch: *On-Off/Mode Selection.*

A toggle switch on the side of the main unit has position for "off", "sensor only" (passive mode), and "light and sensor" (active mode).

MODEL: THRESHOLD AUDICATOR

Cost: $70.00,
with 110v adaptor
Catalog No. T - 1TA

Cost: $55.00,
for battery operated model
Catalogue No. T - 1TB

Type: *Passive.*

Detects the presence or absence of illumination.

Function by Design: *Specific Application — Multiline Telephone/Telephone Switchboard Lights.*

This model of the basic Audicator is designed for detecting lights on a multiline telephone or switchboard. When switched "on" at the beginning of a work period, the Threshold Audicator is ready to be operational but is still technically "off" until a panel lamp or push-button illuminates to activate the photocell and the probe circuit. Thus it does not require switching "on" with each individual use; and, even though it is ready for operation, it will not drain power significantly. Screwdriver adjustment permits setting to accommodate individual light conditions.

Detection Area: *Sensor on Cable.*

Detection area, sensor on cable, is designed for flexibility and mobility during use in detecting the status of lights arranged on a panel as in a multiline telephone or telephone switchboard.

Switch: *On-Off.*

The switch renders the unit operational without activating circuit. Circuit is activated when light strikes photocell through direct contact of detection area with illuminated panel light or pushbutton.

Accessories: *Available.*

For all models of the basic Audicator, accessories are available for attachment via the external jack existing on all units. If another jack is desired for multiple attachments, the customer should consult with Science for the Blind Products. Adaptations for individual requirements are often implemented by the manufacturer prior to purchase of the device.

Accessories are available for other specific tasks such as monitoring liquid-levels and determining values of electrical components; for specific information, consult SFB catalogue. Accessories directly useful with light sensing applications are listed below:

T - 1AV	Volume Control	$6.00
T - 1AE	Earphone Jack & Phone	$10.00

Considerations for Use:

The Reflecticator's black/white sensor at the end of cable allows ease of use and handling in a variety of applications requiring detection of surface reflectivity.

The Threshold Audicator does draw a minimal amount of current when operational but prior to being activated by direct contact with illuminated panel light or push-button. Therefore, the 110-volt-adapted model should be considered for purchase if battery drain is a concern, unless portability is a priority.

SFB Products has a reputation for the ability to effect innovative modifications of products as required for particular applications prior to purchase.

It can be difficult to locate the mercury battery in the Mallory brand which fits the Audicator chassis. It is commonly available only in stores specializing in electronic equipment and components.

The toggle switch on the side of the Audicator models can easily switch "on" during transportation of a battery-operated probe in handbag or briefcase.

Manual: *Catalogue and Product Descriptions. In Print.*

The SFB catalogue and the product description that accompany devices contain information on adaptations, other accessories, and potential applications. Detail is often thorough. In addition, the staff of SFB is available by phone to answer queries from potential customers. Devices can be customized for particular needs.

ADVANCED APPLICATIONS

Barry R. Horowitz, Ph.D. is Associate Professor of Electrical and Biomedical Engineering in the Electrical Engineering Department and the Perceptual Alternatives Laboratory at the University of Louisville, Louisville, Kentucky 40292. He is currently conducting research on the adaptation of chemistry laboratory curricula for access by visually handicapped individuals, and is involved in the development of aids.

An Introduction to Light Probe: Some Properties and Uses

by

B.R. Horowitz, Ph.D.

In many of their common applications, light probes are used to make discriminations regarding gross differences in illumination, i.e,. finding a window, locating the lighted button on a multi-line telephone, or perhaps discriminating between black and white surfaces. As important as these uses are, they only begin to tap the potential of the light probe. Light probes are capable of being employed both in applications that require gross discriminations and in applications that require fine discriminations. In this article, some of the basic properties of light probes are described and some examples of their use are given. In a companion article in this issue, applications of the light probe in the chemistry laboratory are described.[1]

Two types of light probes are available, the passive light *probe,* which depends upon external illumination, and the *active retroreflective probe,* which has its own light source.

Both employ a photodetector that has an electrical output which depends upon both the spectrum and the intensity of the illumination falling on it. An electronic circuit translates the photodetector's output into an audible signal consisting of either tones or clicks; the frequency of the tones, or repetition rate of the clicks; increases for increased intensity of illumination[2]. This is an excellent choice of coding because we, as users, are capable of much finer discrimination of pitch than we are of intensity.

In addition to the photodetector, a retroreflective probe has a light source of its own that is mounted alongside its detector but shielded from illuminating it directly. The source and detector are generally arranged to illuminate and to receive light, respectively, from a small common area that is located a short distance in front of the probe (this is illustrated in Figure 1). Owing to this arrangement, retroreflective probes can often be used in direct contact with surfaces in order to compare the reflectivities of different surfaces, or to determine variations in contrast of a single surface. Examples of such uses include: (a) distinguishing between surfaces having different shades of grey, ranging from black to white; (b) possibly distinguishing between surfaces of different color, such as color-coded wires that have known characteristics; (c) locating a letterhead on an otherwise blank sheet of stationery; and (d) locating blanks on some specialized forms that use shading to define areas. Passive light probes cannot be used in direct contact with surfaces, because they would be positioned between the light source and the surface and would thus block illumination to the surface. In many applications, retroflective probes can be used as passive probes.

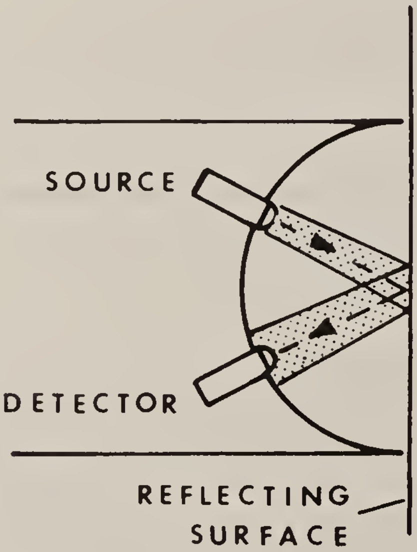


FIGURE 1. Illustration of retroreflective principle. The probe assembly is shown in contact with a reflective surface. Light emerging from the source is shown to diverge; it should be noted that some retroreflective assemblies have lenses that are used to focus the light at a predetermined distance in front of the unit, and to form an image of the illuminated area on the detector.

It is important to observe that a retroreflective probe must be held so that it faces a surface head-on; if this alignment is not maintained, the reflected light may fall outside the detector's entry window. This behavior follows from the law of reflection; at a smooth surface, equal angles are made by the incident and reflected light rays; Figure 1 was constructed according to this principle. A head-on alignment should also be used when using a probe of either variety to examine the space on the other side of a boundary to a transparent medium; if this is not done, refraction may cause the location being examined to be moved off the probe's axis.[3]

Light sources employed in retroreflective probes are usually light-emitting diodes which consume relatively little power and which emit light in the near infrared portion of the spectrum. Their associated photodetectors, usually photodiodes or phototransistors, have their peak responses in the near infrared, but respond to illumination throughout the visible spectrum (i.e., electromagnetic radiation having wavelenths ranging approximately from 0.38 nm, seen as deep violet, to 0.76 nm, seen as deep red; shorter light wavelengths lie in the ultraviolet and longer light wavelengths lie in the infrared). Passive light probes often employ photoconductive devices, which have their peak responses in the visible region, as the detectors. An illustration of detector response is presented in Figure 2.

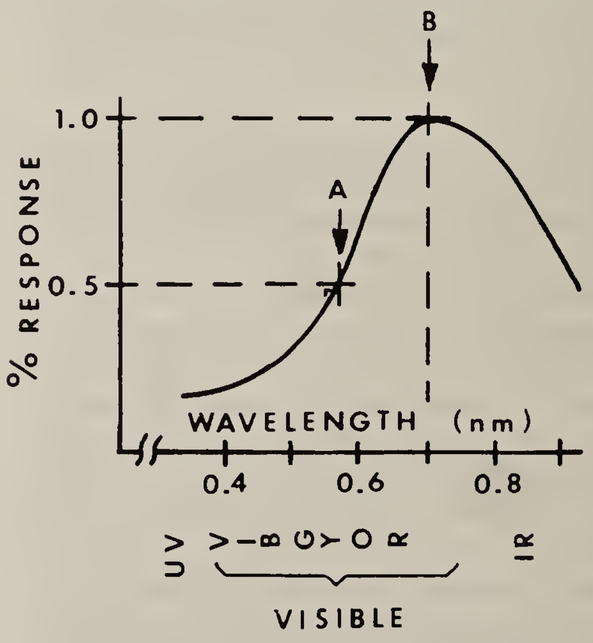


FIGURE 2. Relative spectral response (% of response at the peak) as a function of wavelength for a detector which has its peak response in the red region at a wavelength of 0.7 nm. Approximate locations of the visible spectral colors are shown; from the left: violet, indigo, blue, green, yellow, orange, red. UV = ultraviolet, IR = infrared.

Owing to the detector's *spectral response* (i.e., its output for illumination of equal intensity, but of different wavelength, or spectral color), a tradeoff can occur between variations in spectrum and intensity of the incident illumination; i.e., two sources that are different with respect to both intensity and spectral content may produce identical outputs. This is not a major concern when the probes are used to respond largely to differences in intensity of illumination. However, for applications involving the use of a light probe to compare the illumination produced by different sources, it becomes important to characterize the probe's behavior (see Figure 2 for an illustration).

Both the photodetector and the electronic circuit determine the range of audio frequencies into which a given variation of light intensity is coded. All other things being equal, the larger the range of frequencies, the greater the user's ability to discriminate subtle variations of intensity. Although these fine discriminations are a departure from the uses to which light probes are commonly put, and, therefore, may not be provided for in a given design, such discriminations are important in some of the applications discussed. A measure given by the change in output probe's ability to separate light intensities and can be called its *sensitivity.* As seen from Figure 2, the sensitivity will be dependent on wavelength. Probes having higher sensitivites will produce larger frequency changes for a given change in light intensity. Another measure is the *dynamic intensity range* and is the range of intensities over which the probe provides outputs that are sufficiently discriminable. Intensities above or below this range result in essentially no useful changes in audio frequency. Owing to considerations of the probe's electronics and the range of audible frequencies, a high sensitivity cannot be supported over a wide range of intensities; hence there will be a tradeoff between sensitivity and dynamic range.

It is desirable that the user be able to make comparisons with ease and with certainty. Favorable conditions can be arranged by adjusting the quantity of light reaching the detector so that the resulting pitch discriminations are relatively easy to make. An eventual comparison or adjustment made with the aid of the probe may involve discrimination of two distinct tones, or it may involve seeking a null condition, wherein the lowest attainable frequency or click rate is sought.

A detector is usually most sensitive to light that is incident along its axis and less sensitive to light that is incident off axis (see Figure 3). A measure that describes this property is the *directional sensitivity.* If light is constrained to pass through a cylindrical tube in order to reach the detector, both the amount of light reaching the detector and the angular region, hence area, from which that light can originate, will be reduced. This is illustrated in Figure 4. Longer tubes, of the same diameter, favor light that travels closer to the axis. This simple shield reduces the amount of extraneous illumination that reaches the detector, makes the assembly more directional, and is commonly employed in passive light probes that are commercially available. Slits and apertures of various shapes and sizes can serve to reduce the amount of light reaching the detector and also serve to favor light from particular locations. Lenses can be used to collect light or to focus on particular areas. Neutral density filters, perhaps cut from film that has been exposed uniformly, can be used to reduce the light reaching the detector, and color filters can be used to alter its spectrum. Under some circumstances, the distance between the probe and the light source may be adjusted in order to move the probe's operation into the desired position of its dynamic range.

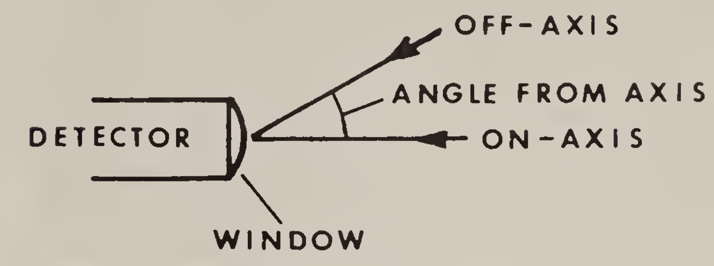


FIGURE 3. Illustration of detector directionality. Detector response is greatest for light incident on axis, and decreases with increasing angle from the axis.

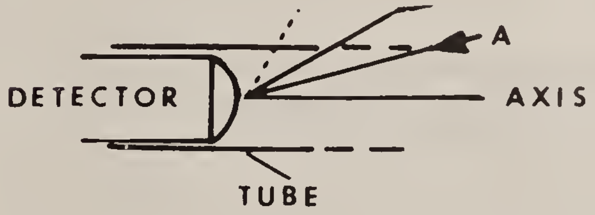


FIGURE 4. Illustration of the use of a cylindrical tube as a light shield. Light arriving at angles larger than that of direction B is prevented from reaching the detector. A longer tube, shown dashed, would exclude direction B and enhance the directionality; the largest angle would now be that of direction A.

If the light source is a separate source, such as a penlight, then much of that said about controlling the light reaching the detector can also be said about controlling the light emitted by the source. In addition, it is often easy to modify the source in order to gain electrical control over its light output. For an incandescent bulb, such changes will affect its operating temperature and hence the spectral content of its output.

Optical fibers can be used to literally channel light to and from points of application. These fibers provide immunity from ambient illumination and, because of their flexibility, provide freedom from the otherwise necessary straight-line paths. Fibers provide an added advantage for some applications; they are easier to position than are the larger and heavier probes. Thus, the fibers may be positioned directly at the point of application while the light source and probe remain further away. An application involving optical fibers is discussed in the companion article.

Acknowledgments

This work was supported in part by the National Science Foundation, Directorate for Science and Engineer-

ing Education, Division of Scientific Personnel Improvement (Grant SPI 8104893). The drawings were prepared by Mr. John F. Kilpatrick and Ms. Lela H. Johns.

References

1. Horowitz, B.R. "Some Applications of Light Probes in the Chemistry Laboratory: A Status Report." Aids and Appliances Review, Issue 7, Winter 1982.
2. Hereafter, the frequency or repetition rate of the probe's auditory output will simply be referred to as the frequency, with the understanding that in a given case, the output may consist of periodic clicks and not a pure tone. The more familiar but subjective term pitch will also be used to talk about the output.
3. Introductory discussions of reflection and refraction appear in: Bureau of Naval Personnel. *Basic Optics and Optical Instruments* (Reprint). New York, Dover, 1969, pp. 30-47.

Some Applications of Light Probes in the Chemistry Laboratory: A Status Report

by

B.R. Horowitz, Ph.D.

Introduction

In this report, some possibilities are presented for the application of light probes to making fine discriminations; the applications are in the chemistry laboratory. Pilot results indicate that, with the aid of adaptations, the same degree of accuracy required of a sighted individual can be achieved by a blind individual.

Our particular applications involve titration and liquid-level sensing, and are being addressed at the University of Louisville as part of an ongoing project to make the undergraduate chemistry laboratory more accessible to visually handicapped students. This discussion describes the effects on which our adaptations are based and reports on the status of those adaptations. Some of the adaptations are merely awaiting final packaging, one still needs some basic work.

In the titration, the light probe is used to sense the color change produced when the procedure is carried out in the presence of a chemical indicator. In the detection of liquid levels, two related applications are addressed: filling a container to a predetermined level and locating an arbitrary level in a container. These applications were carried out with a common underlying philosophy, to use as much existing apparatus or equipment as possible, and when making adaptations, to utilize a low common level of additional technology.

Many of the properties of light probes referred to and the terms used to describe them are defined succinctly in this article; a more detailed discussion of these and other properties of light probes appears in a companion article in this issue.[1] In the applications described, unless stated otherwise, a light shield in the form of a cylindrical tube was used at the input end of the passive probes. Such an arrangement reduces extraneous illumination and is commonly employed on passive light probes that are commercially available.

In order to carry out efficiently some of the applications described, the visually handicapped individual will require the means to dispense liquids in a controllable manner. Possibilities include syringes, pipettors, ordinary burets, and piston burets. We are currently evaluating different approaches to liquid dispensing and will report on them in the future.

Titration

Titration Procedure: In the titration procedure, two solutions, one of known concentration and the other of unknown concentration, are combined by adding progressively one solution, called the titrant, to a known amount of the other, until the reaction between the two is complete; i.e., equivalent amounts of the two solutes have reacted. In this way, the unknown concentration may be determined.

In order to know when to stop adding the titrant, the reaction's completeness (reaching of the equivalent point) must be sensed. In acid-base titrations, a pH meter or an appropriately chosen chemical indicator which changes color in the vicinity of the equivalence point may be used. The indicator method is ideally suited for use with light probes.

For the tirtation of a strong acid and a strong base, say hydrochloric acid and sodium hydroxide, phenolphthalein is an easily used indicator if the titration is performed by adding the base to the acid. The procedure is as follows: A solution containing the acid is put into a small container, to which a couple of drops of the colorless indicator are added. Phenolphthalein remains colorless in the presence of aqueous acid solutions, but turns red in the presence of a base; the transition takes place in the pH range of 8 to 10. Base is now added slowly and progressively from a buret, using the stopcock to regulate the flow, until the faintest of pinks appears and persists throughout the solution; this is the end point of the titration. Addition of yet another drop (there are approximately 20 drops per milliliter) of base will cause the solution to burst into a deep pink. Constant mixing during the procedure ensures a homogeneous solution. This is easily accomplished by placing an encapsulated magnetic stirring pellet in the solution and placing the beaker atop a magnetic stirrer. As the end point is approached, the addition of base causes small bursts of pink to appear in the container; they fade into colorlessness as mixing occurs.

It is not uncommon that a given titration be carried out two or more times, using equal quantities of acid each time. A rough cut at the titration is often performed, allowing the titrant to be dispensed relatively quickly, and overshooting the end point. In this way, the approximate volume of titrant required is found. On the second cut, a lesser amount of titrant is added so that the end point is approached, but undershot. Now, smaller amounts of titrant are added slowly until the end point is reached. This procedure allows the titration to be performed with some dispatch. Volume readings on the buret containing the titrant are taken prior to and directly following the titration; their difference is the volume of base needed to reach the endpoint, and is a quantity used in subsequent calculations.

Basis for Use of Light Probe: Prior to reaching the vicinity of the end point, light absorption by the solution is low and is fairly uniform over the visible spectrum. As the end point is approached, absorption increases and becomes wavelength selective, resulting in a color change. By using a light probe to monitor a light beam passed through the solution, the end point can be detected via the attendant decrease in transmission.

A Typical Setup: Figure 1 schematizes a typical setup for using a light probe to monitor a titration. A beaker containing the acid solution, a couple of drops of indicator, and a stirring pellet is centered on the magnetic stirrer. The buret or other delivery device containing the base is positioned above the beaker; its contents should be deliverable without splashing. The beaker is positioned to allow the stirring pellet to rotate in the center of the beaker; a slow but steady speed of rotation which results in a relatively shallow vortex (no deeper than approximately one-third of the solution height) and acceptable mixing rate is chosen. A penlight or a small collimated source, if available, serves as the light source and is positioned to allow the light beam to pass through the relatively undisturbed portion of the solution, below the vortex and above the pellet; the probe is positioned diametrically opposite to the penlight and is adjusted to place the detector in the center of the transmitted beam. This arrangement results in a steady pitch from the light probe. If the light is influenced by either the vortex or the rotating pellet, the light intensity will be modulated and a warble will be heard instead. Markings on the beaker will cause scattering and will reduce the light transmitted; it is not difficult to position the beam so that it enters and exits the beaker through clear areas on the glass.

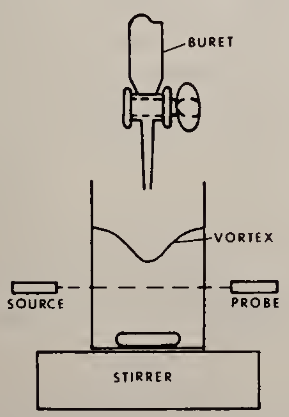


FIGURE 1. Setup for using light probe to detect the end point of a titration.

Titrating with Aid of the Probe: As titrant is added, the pitch of the probe's output is monitored. Depending on the local geometry in the beaker, the position of the light path, and the sensitivity of the probe, disturbances caused by the addition of titrant may be heard. Furthermore, the wispy pinks that appear and then fade as the end point is approached can often be heard as a momentary lowering of the pitch. The time course of these changes depends on the events themselves and on the probe's electronics. Once external events occur, there are time delays associated with the pitch transitions; the delays for pitch transitions from low to high and from high to low may be different for the two transitions, and are different for different light probes. The first permanent pink, indicating the end point, is heard as the first permanent lowering of pitch. Once the end point is reached, the addition of an extra drop will cause the contents of the beaker to turn deep pink, with an attendant further lowering of the pitch. It is noteworthy that by adding titrant drop-by-drop once in the vicinity of the endpoint, an endpoint that was later identified visually as a very faint pink could be arrived at by an individual who carried out the titration by relying solely upon the audible output of the probe.

Students are sometimes instructed to carry out the titration in an Erlenmeyer flask. A beaker was used instead; unlike the flask, the sides of which slope sharply inward toward the neck, the beaker has cylindrical sides, which favor the use of the probe. A 100 milliliter beaker with approximately 50 milliliters of initial contents was found adequate. In preparing the setup for titration with aqueous solutions, distilled water can be added, if necessary, to increase the volume in the beaker, without affecting the result of the titration. Beaker diameter will affect the pitch change. Larger diameter beakers provide longer paths, thus resulting in greater absorption (lower transmission) and lower pitch; this assumes that only the beaker diameter is changed, and not the concentration of the contents. It was found helpful to use an extension tube, having a horizontal exit slit, on the light source. This arrangement provided a beam with a small vertical extent, and eliminated light that otherwise might scatter from the vortex or the pellet.

Liquid-Level Determination

Mechanism for Sensing Meniscus: Use of a light probe to determine the level of liquid in a container involves detection of the meniscus, the curved upper surface of a column of liquid. The geometry of the meniscus depends upon the material of which the container is made, the contents of the container, and the diameter of the container. A concave meniscus is formed when the container walls are wetted by the liquid and a convex meniscus is formed when the walls are not wetted. Water forms a concave meniscus in a glass container, whereas mercury forms a convex one. Curvature of the meniscus is greater in small diameter containers than it is in large diameter ones. The following discussion applied to clear glass containers, with aqueous contents.

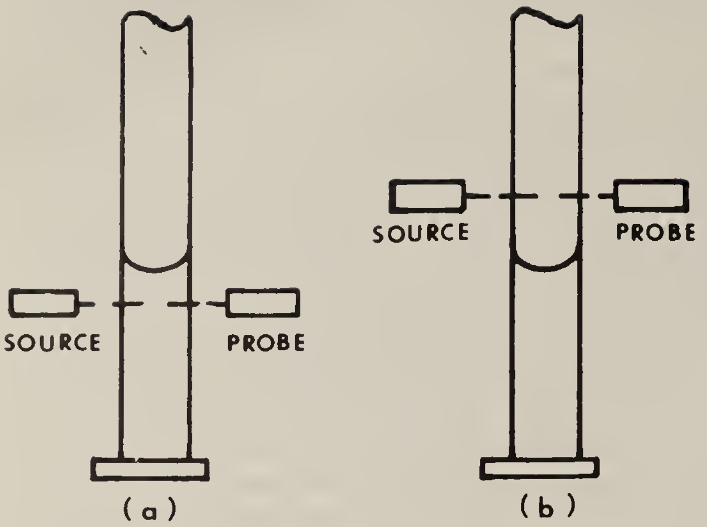


FIGURE 2. Light probe monitoring a light beam passed through a container; (a) beam passes through liquid, (b) beam passes through air space above liquid.

Figure 2 shows a light probe monitoring a light beam that is passed through a container. In (a), the beam passes through the liquid and in (b), the beam passes through the air space above the liquid; in both cases, the beam is a fair distance removed from the meniscus. Differences in pitch will be due to differences in the light transmitted, or alternatively lost; the higher the losses, the lower the pitch. Reflection losses occur at the container walls; absorption and scattering losses occur in the contents. Multiple reflections aside, differences in reflection losses occur at the inner container walls and losses will be lower for paths through the liquid than for paths through the air, because the liquid is a better optical match for the glass than is the air.[2] Absorption and scattering losses will be greater in the liquid; these losses increase with container diameter. In most situations, the pitch will be different above and below the meniscus; the exact relationship will depend upon the container, its diameter, and its contents. These pitch differences alone, could serve to distinguish a beam of narrow vertical extent that passed just above the meniscus from one that passed just below the meniscus.

Transmission of the beam through the curved meniscus is interrupted by a switch-like behavior that is caused by total-internal reflection, resulting in extremely low transmission and therefore very low pitch. Recall that total-internal reflection essentially prevents a light beam from crossing a boundary between two media, and may occur when a beam that is traveling in one medium is incident upon a boundary to a less dense medium, in this case water and air, respectively.[3]

Lowest transmission of a beam of narrow vertical extent occurs when the beam is located a fraction of the meniscus height above the low point of the meniscus. For non-opaque liquids, this pitch is markedly lower than that of either case discussed previously. Figure 3 illustrates total-internal reflection of a narrow beam of light at the meniscus. A horizontal exit slit on the light source and a corresponding entry slit on the detector serve to permit finer localization of the meniscus.

A somewhat different mechanism forms the basis for detection of the meniscus with the aid of a retroflective probe, which contains both a detector and a light source; here, the light that is reflected back to the probe is monitored. For situations that are analogous to those depicted in Figures 2 (a) and (b), different percentages of the light that is incident at the inner boundaries of the container will be reflected back in the two situations, owing to the different materials, liquid and air, in contact with the container in the two cases. Moreover, the light that is reflected back through the liquid from the far side of the container will have passed through the solution twice. The effect of the returning light is more pronounced in containers having relatively small diameters. It can easily be verified that reflections from the far side of the container play a role; position the beam below the meniscus and slide a finger or other object into the container along the far side and observe the effects on the audio output. Strong pitch changes will again be present directly at the meniscus; and changes will depend upon the particular orientation, both of the probe with respect to the meniscus and of the source and detector within the probe. Total-internal reflection again plays a role at the curved meniscus and produces a very low pitch. Markings on the container will interfere with the measurements if they interrupt the light beam. In fact, retroreflective probes are ideal for purposefully locating these markings.

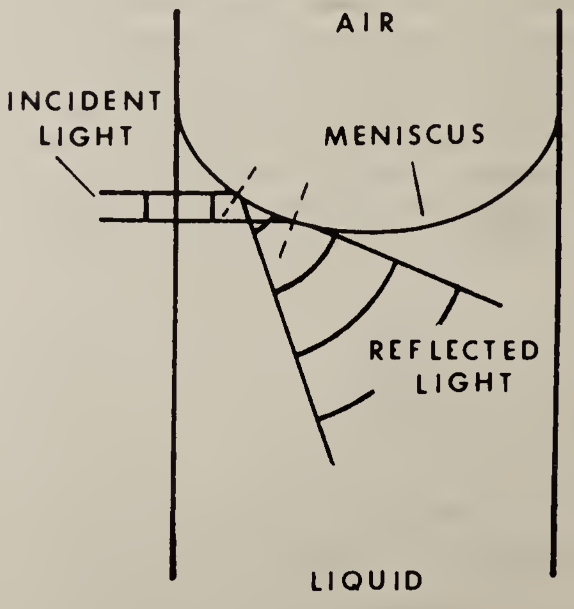


FIGURE 3. Total-internal reflection of a light beam at the meniscus. The dashed lines are used to indicate that, for reflection at a smooth surface, the angles of incidence and reflection are equal. The grazing rays produced at the surface are omitted for clarity.

Filling to a Predetermined Level: In preparing standard solutions in making dilutions, and in transferring precise amounts of liquids, it is often necessary to fill a container such as a volumetric flask or a volumetric pipette to a line that has been etched round the circumference of a cylindrical portion of the container. The flask is closed at the bottom and liquid is added from the opening at the top until the bottom of the meniscus is aligned with the etched line. The pipette is open at both ends; liquid is sucked up through the bottom, its level is adjusted to coincide with the mark, and it is held in the pipette by suction until it is released into the delivery container.

In both cases, the meniscus will be curved sufficiently to cut off transmission of a narrow beam. A number of physical arrangements are possible using separate sources and detectors as well as retroreflective probes; one approach that is easy to implement and which allows accurate filling is described. Black vinyl electrician's tape was used to create two opaque bands on either side of the fill line, thus forming a slit at the location of the fill line. A slit width of between 1/2 and 3/4 millimeter was used. Recall that the lowest transmission occurs when the bottom of the meniscus is somewhat below the beam center (see Figure 3). In order to compensate for this, the center of the slit might be raised slightly above the fill line; the displacement could be specified for each container diameter, assuming aqueous contents. Using slits that were centered on the fill line, a comparison was made between filling to the line visually and filling to the slit using a light probe to monitor transmission, for a 100 millileter volumetric flask and a 5 millileter volumetric pipette. In both cases, filling to the slit resulted in a slight underfilling, as expected, with a 0.8% error for the flask and a 0.5% error for the pipette.

Flask: A typical setup is shown in Figure 4. By mounting the light source and probe in clamps on ring stands, they can be aligned to one another through the slit on the flask. Extension tubes or other shields should be used as needed so that the detector is illuminated through the slit on the flask, rather than around it. Liquid may now be added until the pitch is reduced to its low value; if the mark is overshot, the pitch will rise. While this arrangement does permit accurate filling, it is painfully slow. Only the end result is detected, so one never knows how close the level is to the line, nor how fast to add liquid. It is not generally permissible to overshoot the mark and then remove liquid, as an error will already have been committed if standard solutions or dilutions are being prepared. Another tack is needed.

A thin block of wood placed under the flask following the alignment procedure would cause a location below the fill line to be monitored. A slit at that location is optional. Now, liquid is added to the flask relatively quickly until a pitch change is heard; the block is then removed, the flask repositioned with its slit in the beam, and dispensing is continued in a drop-by-drop fashion. A buret, for example, could be used to dispense the liquid. During filling of the flask, temporary pitch changes may be produced by liquid that crosses the beam; the dispensing rate should be regulated so that such changes can be distinguished from the permanent ones. An alternative approach to the block is the use of two light probes, or a single probe with two detectors.

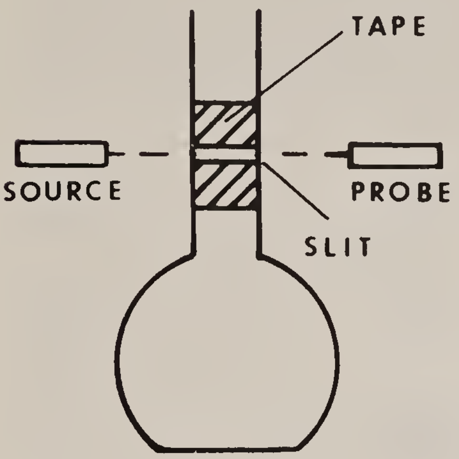


FIGURE 4. Setup for using a passive light probe to monitor the filling of a volumetric flask.

Pipette: Essentially, the same arrangement could be used with a pipette. For stability, the pipette could be held by a buret clamp mounted on a ring stand. Extra care would need to be taken to prevent light from reaching the detector around, rather than through, the thin pipette (the 5 ml pipette used has a diameter of 8 mm, 5/16 in., at the fill line). A different arrangement, shown in Figure 5, was used with the pipette, which can be employed either in a hand-held manner, or clamped in a buret clamp and used as a dispensing station. Again, a slit was created with black electrician's tape. Light was directed to the entry side of the slit by a fiber-optic light guide, consisting of a flexible vinyl-jacketed bundle of plastic fibers which trap and guide light via total-internal reflection. An inexpensive commercially available penlight-fiber-optic illuminator was used.[4] The free end of the fiber bundle was trimmed with a razor blade and inserted into a short stiff sleeve which provided mechanical support. This assembly was then fitted into one side of a hole bored along the diameter of a 1-½ inch cork that also had a hole bored lengthwise through its center so that it would sit snugly on the pipette at the location of the slit. A light detector, connected by a wire to a light probe, was fitted into the other side of the hole along the diameter; it received the light emerging from the exit side of the slit. A small amount of tape held the fiber-optic illuminator and the detector in place. As alternatives, a second length of light guide could receive the emerging light and direct it to a light probe; a light-emitting diode or a small lamp assembly could be used in place of the fiber-optic illuminator.

A commercially available pipette filling aid,[5] which operates like a large syringe, was used to enhance control of the filling operation. Here it is permissible to fill above the mark, but not so far as to draw liquid into the filler itself, and then dispense a small amount to adjust the contents to the mark. It should be noted that because the pipette is filled by suction, the liquid level will rise more slowly than the plunger in the filling aid. Thus, the pipette should be filled relatively slowly to prevent overfilling. The pipette is filled until a pitch change is heard; it will now be filled above the fill line. Liquid is now allowed to escape very slowly, until the meniscus is heard to cut off the light. It is not unusual that one will have to home-in successively to the filled condition. Availability of a filling aid that allows tighter control would be of considerable help here.

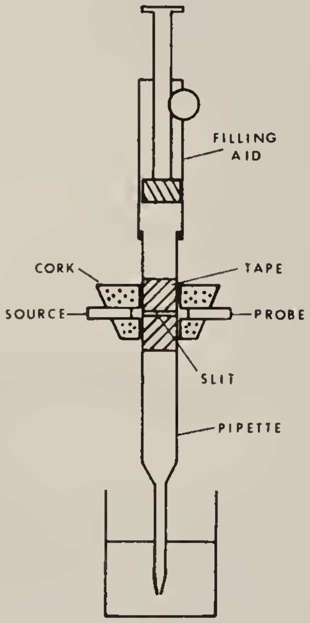


FIGURE 5. Schematic of the setup for using a passive light probe to monitor the filling of a volumetric pipette.

A retroreflective probe could also be employed for the filling task. The narrow slits would not be used, and some means for accurately aligning the active portion of the probe with the fill line would need to be devised.

Locating an Arbitrary Level: An arbitrary level can be located using the same principles. A light source and detector could be mounted, in a direct line path, on a mechanism that could be moved vertically. A container would be placed in the path and the mechanism adjusted until the null produced by the meniscus is heard. Such a custom-made liquid level detector was designed and constructed at New Jersey Institute of Technology's Macrolab, for use by blind students.[6] The device can determine liquid level in containers as long as 30 inches with diameters of between 1/2 inch to 6 inches. Both fast and micrometer motion are provided, along with tactual readout. Such an arrangement is accurate, but expensive to duplicate. At the present time, there appears to be no middle ground solution which lies between this device and the combination of a hand-held retroreflective probe and a tactile rule. It is not difficult to imagine any number of simple devices that make use of the principles described to locate the meniscus. But, that is where it ends; once the meniscus is located in space, some other means is needed whereby that spatial location can be read out.

User Training

For many, these are new uses of the light probe and a little experimentation will serve as an excellent familiarization exercise. It can be useful for the visually impaired individual to perform representative trials with a sighted assistant who describes things such as the vortex, the color changes, the meniscus, and the light path which can be made visible by adding a little milk or a very small amount of ink to produce scattering. In this way, the pitch changes can be firmly associated with the salient events in an efficient manner. One should feel free to experiment by changing the absorption, for example, and by violating directions, just to see what will happen. These explorations serve to enhance learning by providing the varied experiences that are necessary for a fuller interpretation of the audible output.

A Homemade Light Probe

A number of commercially available light probes were tried in some of the applications discussed. On the whole, they functioned well in the sensing of liquid levels. Titration, however, proved to be a bit problematic for our criteria; pitch changes produced by the appearance of the faintest of pinks were not as large as was desired to permit ease of use. A light probe that was built in our laboratory, for another purpose, provided the desired pitch change. That probe was employed in our prototype adaptations; the schematic diagram of the basic circuit is given in Figure 6.

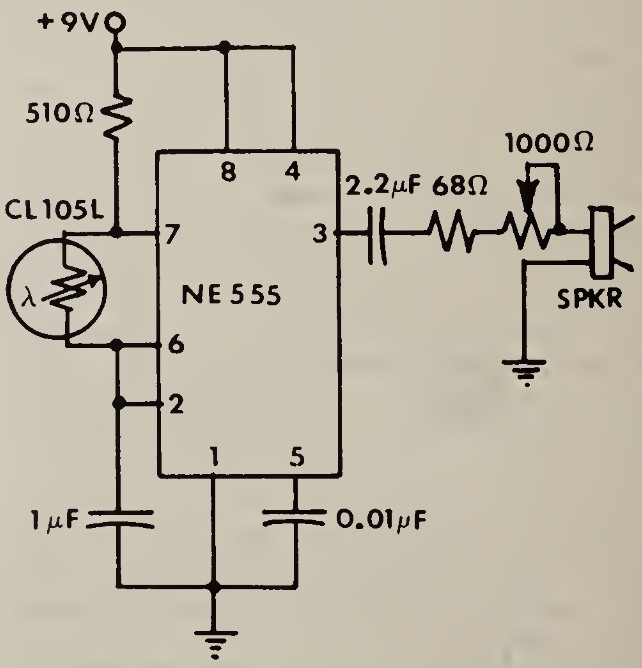


FIGURE 6. Basic schematic of homemade light probe. For use with an earphone, the volume control should be changed to 3000 ohms.

Acknowledgments

This work was supported in part by the National Science Foundation, Directorate for Science and Engineering Education, Division of Scientific Personnel Improve-

ment (Grant SPI 8104893). Mr. William Skawinski of N.J.I.T.'s Macrolab provided a helpful discussion. Two of the author's colleague's, Drs. Joseph C. Deck and Emerson Foulke, took part in the evaluation of adaptations and provided helpful discussions. Mr. John F. Kilpatrick and Ms. Lela H. Johns prepared Figures 1-5; Mr. Kilpatrick also aided in the design of the probe and contributed suggestions for the improvement of the presentation.

References

1. Horowitz, B.R., "An Introduction to Light Probes: Some Properties and Uses." Aids and Appliances Review, Issue 7, Winter 1982.
2. Introductory discussions of reflection and refraction, as well as photographs that illustrate effects of optical matching, appear in: Bureau of Naval Personnel. *Basic Optics and Optical Instruments* (Reprint). New York, Dover, 1969, pp. 30-47.
3. Ibid., pp. 40-42.
4. The Flexilight which consists of a penlight, a 2 ft. long vinyl-jacketed bundle of plastic fibers, and an adapter to attach the bundle to the penlight, was purchased from Edmund Scientific, 101 E. Gloucester Pike, Barrington, New Jersey 08007.
5. The filling aid used and depicted in Figure 5, is the Pi-Pump® manufactured by Bel-Art Products, and distributed by chemical supply houses. In order to obtain enhanced control of filling during pilot testing, a spring-like piece of plastic was affixed to the barrel and held against the knurled wheel to provide a ratchet action.
6. Cochin, I. and Herman, H. *The Macro Lab: A Center for the Handicapped at N.J.I.T.* Final Project Report to NSF Program, Physically Handicapped in Science (NSF SPI 8005432). Newark, New Jersey Institute of Technology.

THE HOMEMADE LIGHT PROBE

Introduction

For those with some experience in electronic circuitry and for the technical experimenters, the building of a light probe is a relatively simple task. In fact, the light probe has developed as a result of individuals with technical background making light probes for themselves or their friends. The advantage of building a homemade light probe is that the user can design the probe for his own specific applications. This allows the needs of the user to become the guidelines for the final device.

For the general public, one of the first articles on building a homemade light probe was published in *Popular Electronics,* March 1973; written by Forrest M. Mims, the article is entitled, "Build a Light Probe." In April 1981, *Popular Electronics* published an expanded and updated article by Forrest Mims on the light probe: "Electronic Aids for the Handicapped." Mr. Mims, who is currently a contributing editor for *Computing and Electronics* (formerly *Popular Electronics),* cooperated extensively in making the arrangements to have his two articles reprinted here in Issue No. 7 of AAR. For permission to reprint these articles, we wish to thank Forrest Mims; Ziff-Davis Publishing Company, publisher of *Computing and Electronics;* and McGraw-Hill Book Company, publisher of *The Forrest Mims Circuit Scrapbook.* Both of these articles provide a good technical understanding of circuitries available in building light probes with specific features and capabilities. These articles grew out of the author's long standing interest in helping blind persons and in light detection, and he plans future articles on other aspects of light detection as it affects those who are blind. We are most grateful that Mr. Mims has allowed us to share this information with our readers; we have excerpted portions relating directly to the building of light probes for use by blinded individuals.

Other homemade light probe circuits are available from a variety of sources. The circuit for the light probe designed at Smith-Kettlewell Institute has been published in the Annual Report of Progress, April 1978 – March 1979, of the Rehabilitation Engineering Center of the Smith-Kettlewell Institute of Visual Science. William Gerrey, involved in the design of the light probe and editor of Smith-Kettlewell's *Technical File,* states that a future issue of his journal will also present the circuit for this light probe which is now manufactured and distributed by the San Francisco Lighthouse for the Blind. The *Technical File* is available to the public by subscription.

Electronic Aids for the Handicapped

by

Forrest M. Mims

One of the most rewarding activities that an electronics experimenter can pursue is the design and construction of electronic aids for the handicapped.

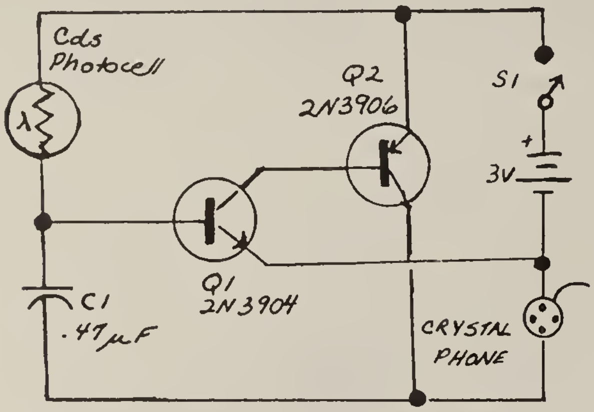


Fig. 1. Simple transistorized light probe for the blind.

AIDS FOR THE BLIND. Probably the simplest gadget you can build for a blind friend or relative is a light probe that produces a sound when a photodetector is illuminated. Light probes date from 1912 when British scientist Fournier d'Albe built a device he called the "Exploring Octophone." It employed a selenium cell in a Wheatstone bridge and generated a musical tone as light intensity was varied.

You can build an updated version of d'Albe's light probe (Fig. 1): This circuit [which is described in "Build a Light Probe: Electronic Help for the Blind" reprinted on page 26 of this issue] can be easily installed in an aluminum or plastic cigar tube (Fig. 2).

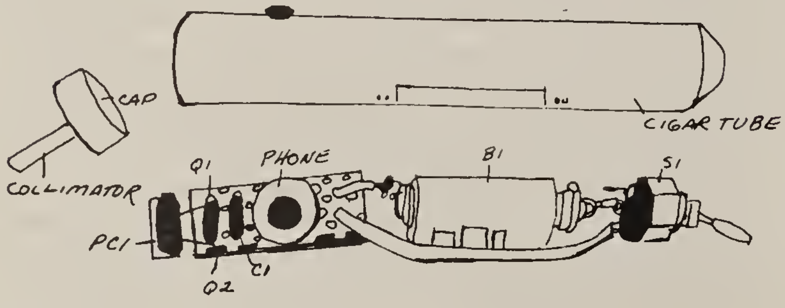


Fig. 2. Construction of a light probe in a cigar tube.

The circuit is a two-transistor regenerative amplifier. Its frequency of oscillation depends on the amount of light striking the sensitive surface of the cadmium-sulfide photocell.

Audio output is supplied by a crystal earphone that serves as a miniature speaker. The volume is sufficiently high so that the user can hear the tone, but it is not so loud as to distract nearby persons.

The probe can be made much smaller than the unit described above. Several years ago, I built a probe, complete with mercury button cell and hearing-aid receiver, into a small plastic tube measuring about 3/8" x 1". This was made possible by the tiny but surprisingly effective hearing-aid receiver unit I used in its construction. I intended to attach the probe to a key chain but, because of its small size, I promptly misplaced it.

There are many ways to make circuits which produce a tone whose frequency is dependent upon light. Figure 3, for example, is an IC version designed around the readily available, inexpensive 555 timer. This circuit is very sensitive and can be adjusted to provide various frequency ranges and threshold levels, but it consumes more current than the circuit shown in Fig. 1.

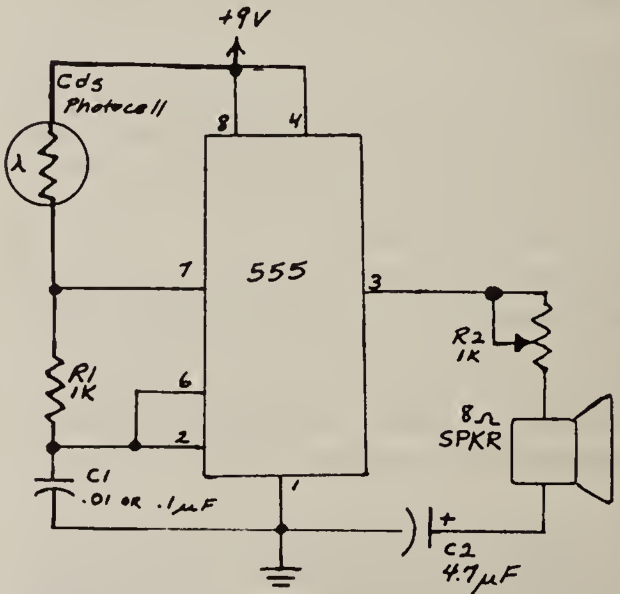


Fig. 3. A 555 light probe with high-volume output.

An important advantage of the circuit in Fig. 3 is that it can provide more drive current to a small speaker or other transducer than the transistor circuit. This may prove a significant advantage to blind people with a hearing problem, a not uncommon combination among older individuals.

Still another light probe circuit is shown in Fig. 4. This circuit uses the amazingly versatile LM3909 LED flasher chip as a light-controlled audio oscillator.

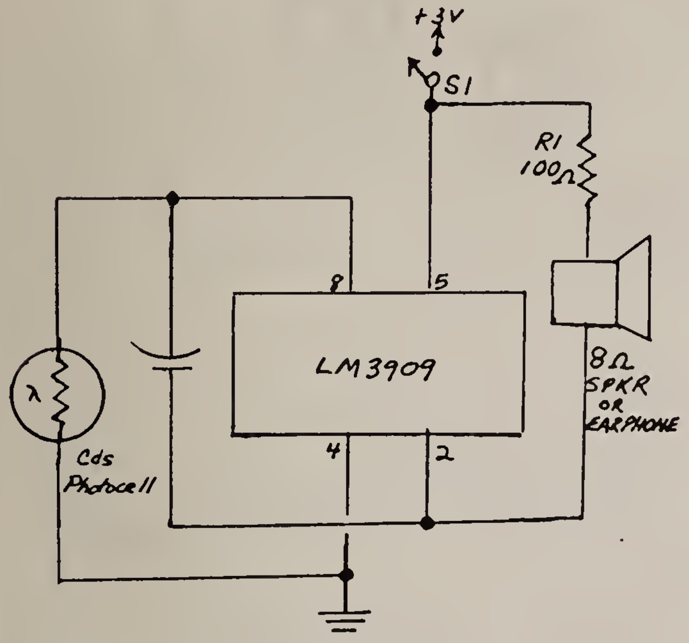


Fig. 4. A light probe circuit using an LM 3909.

Partial or even total loss of vision can be an unfortunate side effect of advanced diabetes. A modification of the light probe concept can be used to help blind diabetics perform their own tests of the sugar level in their urine.

Urinary sugar content is ordinarily determined by dipping a strip of test paper into a specimen. Color changes in the paper denote the sugar level. You can detect the color of a test strip by making a light-tight chamber fitted with a cadmium sulfide photocell and a small lamp. When a test strip is placed in the chamber, the resistance of the photocell will be determined by the color of the strip.

I built a urine-monitoring device similar to this in 1966, and at least one such device is commercially available today. [See AAR, Issue No. 6, June 1982 – "Diabetic Control: Equipment for Use with Vision Loss."] If you want to assemble one for a blind diabetic, spend the time to calibrate it carefully. Make sure the unit can be reliably operated by a blind person. Erroneous readings from the unit could prove extremely hazardous to a person who uses it.

To experiment along these lines, Fig. 5 is the schematic of an elementary circuit with which you can get started. The operational amplifier, operated without a feedback resistor so that it functions as a comparator, has its switching threshold determined by the setting of R3. The photocell is one section of a voltage divider. When the divider output reaches the switching threshold set by R3, the comparator actuates the tone generator made from two of the gates in a 4011.

In using this circuit, the photocell is pointed at an illuminated test strip (you can obtain test paper at a pharmacy). The output of the divider is a voltage representative of the reflectance of the strip. Potentiometer R3 is then adjusted until the tone is heard. Raised markings at predetermined points form a scale for the control knob, which should have a stubby pointer that a blind person could "read" easily.

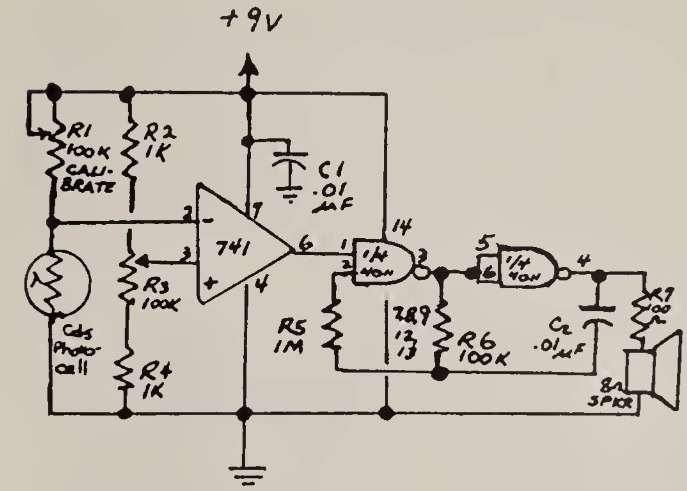


Fig. 5. Color detection circuit for urinalysis.

Build a Light Probe: Electronic Help for the Blind

by

Forrest M. Mims

Here is a chance to provide a simple-to-use light probe that will enable rapid location of pilot lights on a panel, switchboard, or multi-extension telephone; orient position with respect to the sun; or even "read" the hands on a conventional clock.

A blind person can use the probe to detect the presence or absence of artificial illumination within a room; and it could even be employed to read the waveforms on a scope.

The circuit (Fig. 1) consists of a simple two-transistor audio oscillator whose output frequency is dependent on the amount of light striking the sensitive surface of a photoresistor(PC1). The prototype has a frequency range of up to 5500 Hz, depending on the amount of light striking PC1.

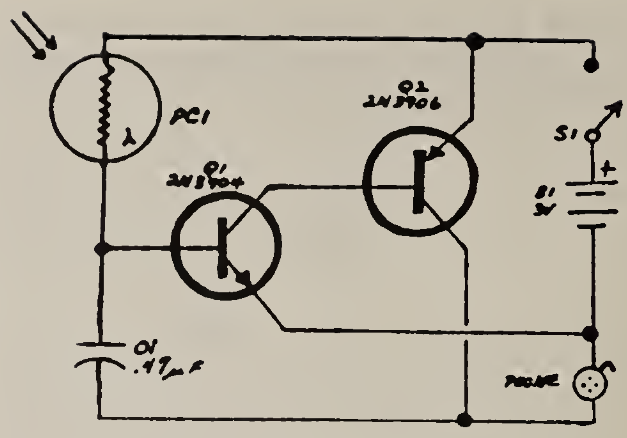
CONSTRUCTION. As shown in Figure 2, all components except for the battery and on-off switch are mounted on a 1-3/4" x 1/2" piece of perf board. The photoresistor is mounted at one end, at right angles to the board. Before mounting the miniature earphone which is to act as the speaker, remove the plastic sound guide (the part that goes into the ear), cut the leads to about one inch, and remove a small portion of the insulation. Push the leads through a hole in the board, press the earpiece close to the board and solder the two leads in place to secure the earpiece. A drop of cement may be used to form a secure mount.

The final assembly is best made in an aluminum cigar tube measuring 5-1/4" x 3/4". Lay the finished perf board assembly beside the tube and mount a battery clip (for the 3-volt alkaline battery) and switch S1 so that S1 will protrude through the round end of the cigar tube (see drawing). Use heavy wire for this installation so that the entire assembly can be easily inserted or removed from the tube.

Use a sharp punch and miniature file to form the mounting hole for S1 at the round end of the tube. Do not use a drill for this hole, unless you have a small hobby-type drill, as the aluminum tube is very thin and can distort very easily. Another hole, this one about ¼" in diameter, should be made in the wall of the tube, directly opposite where the speaker will be located when the assembly is in the tube.

The assembly must be made so that the sensitive surface of the photoresistor is close to the open end of the tube. You can either make a small hole in the cigar tube cap to allow the outside light to strike the photoresistor, or you can use a discarded clock gear wheel having a hollow axle as a light guide. The axle can be inserted from the inside of the cap and the gear wheel cemented to the cap as the support.

OPERATION AND USE. To test the probe, turn on S1 and aim the probe at different light sources around the room. There will be many different tones heard as the probe sweeps the room. If you find that the probe is too sensitive and cuts off at relatively low light levels, use a small piece of polarizing material on the interior of the light hole in the cap and another small piece covering the photoresistor. (Be sure that the cement does not cover the sensitive surface.) The light input can then be controlled by rotating the cap to cross the polarizers.



PARTS LIST

B1- 3-volt alkaline battery (Eveready 532 or Mallory PX-24)
C1- 0.47-μF, 6-volt capacitor
PC1- Cadmium sulphide photoresistor (Calectro J4-805, RCA SQ2429,Clairex CL5MAL)
Q1- Transistor (2N3904, HEP736)
Q2- Transistor (2N3906, HEP715)
S1- Spst miniature toggle switch
SPKR- Miniature earpiece
Misc.- 1 3/4" by ½" perforated board, aluminum cigar tube, battery clip, hook-up wire, collimator tube.

Fig. 1. Output frequency of oscillator circuit is determined by light striking PC1.

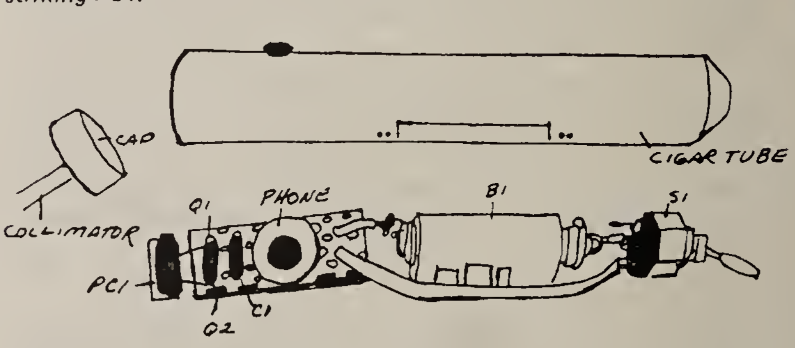


Fig. 2. Components, except for battery and switch, are mounted on a small piece of perf board and entire assembly is inserted in aluminum cigar tube with light collimator in cap.

The light probe can be modified for special applications. For example, a miniature lamp mounted near the cap can be used to illuminate dark areas to improve the probe's ability to "read" clock hands or meter pointer positions. A blind electrical engineering student has successfully used the prototype with a narrow-bore light collimator (tube) to read the waveforms displayed on a CRT and the panel lights on a computer board.

ILLUSTRATIONS by Carolyn DiTullio.

The Light Probe: History of Development and Marketing

Our purpose in compiling this issue of AAR was two-fold. We wanted first to provide up-to-date and accurate product information, but our larger goal has been to stimulate further development and distribution of this simple, versatile device to persons who might make use of it. Because the light probe seems so susceptible to practical modifications when required for specific tasks, it would appear to have a great deal of unexplored potential. A brief chronicle of its invention, development, and life as a commercial product demonstrates further its adaptability and suggests directions for future development.

Information about the early development of the light probe comes from William Gerrey of the Smith-Kettlewell Institute. In general, information is frustratingly sparse. Perhaps this is because, as Gerrey puts it, "The light probe has had a myriad of inventors." But he identifies its first inventor as Noiszewski in Poland in 1879. And as early as 1861, it was observed by Joseph May, who worked in a cable station off the coast of Ireland, that the selenium resistors in his instruments reacted to sunlight falling on them and caused his instruments to malfunction. This may be the first discovery that light can affect the flow of electrical current, the principle basic to the circuitry of a light probe.

Though the light probe has been in existence for just over 100 years, it has been commercially available for less than 50 years. To say that the light probe had a myriad of inventors is to say that everyone built his own before the probe was commercially available. A. Wexler, the Australian inventor of the light probe which eventually served as a prototype for the RNIB probe, mentions a use of the light probe as early as 1938, when Dr. E.J. Waterhouse built a probe which would enable his blind science students to detect and calculate the degree of the sun's elevation from the horizon. This early example of an electronic light sensing device with an audible signal consisted of a photoelectric cell and a buzzer and indicated only whether some light was shining on the photocell or not. From these beginnings, the development of the light probe has been toward greater technical refinement and greater focus on development of devices for a specific kind of application or with specific functions. One factor which contributed to this course of development has been technological advance in the miniaturization of electronic components and in the speed with which electronic circuitry can perform a given function. With the availability of such components as light sensing modules, assembly of small, accurate, and durable devices easily adaptable to a range of specific applications has become practicable.

The marketing history of the light probe really begins in 1952 when the American Foundation for the Blind brought out a meter-reader light probe, which cost then about $30.00. Containing a light sensor, the probe could "look" through the glass over a meter and detect the position of the black pointer on the white face; to read the meter, the sound of the light probe would be correlated with a tactual representation of the scale on the meter's face.

In England, in 1958, the Royal National Institute for the Blind developed their probe, described in this issue's Resource Guide. As mentioned above, it was modeled on the prototype devised by the Australian inventor Wexler. The prototype was also sent to Science for the Blind for evaluation. Though intrigued with the capabilities of the device, Dr. Benham was disappointed in the probe's physical design: "The only trouble with it was that it was in the form of a fountain pen and had a rotary switch on the top. The switch had to be turned on with each use so that if the probe was being used to monitor extension lights on a telephone switchboard, there were difficulties. With each use, the person had to stop, pick up the probe, search for the light source, then turn the probe off, and put it down. If it was not turned off with each use, the battery would last about a day. And there was another problem. Because it was shaped like a fountain pen, it rolled. The person would put the probe down, and the next time he wanted it, the probe would be out of reach."

It is perhaps this experience with a probe shaped like a fountain pen that prompted Science for the Blind to develop their version of the light probe. Housed in a square case with an available switch, their light sensors, the Relecticator and the Audicator, came on the market between 1963 and 1965. The Audicator was the first versatile, general purpose light probe in the United States. The Relecticator, like the AFB light probe marketed in the 1950s, was designed to read meters exclusively. Both probes are still available for their original applications.

Another significant light probe development in the late 1960s was the Paper Money Identifier, the first active probe readily available commercially. Originally developed by Marchak Engineering Company in Texas, the PMI was billed as a byproduct of NASA's aerospace research and development efforts. It is currently distributed by Applied Rehabilitation Systems of Austin, Texas, at a cost of approximately $200.00. A company spokesperson reports that sales have actually increased during the current economic hard times. She speculates that it is increasingly important for blind vendors to be certain of the denominations of currency during transactions.

The 1970s saw an even greater refinement of the light probe as a commercial product than did the 1960s. The Bejed Pioneer Light Probe, developed in 1971, specifically for use by a blind person working as a switchboard operator or telephone receptionist, came on the market. The prototype was first fabricated by two Pacific Northwest Bell Telephone engineers at the request of the supervisor of a newly hired blind employee. The rights to the probe were then given to the Oregon Chapter of the Telephone Pioneers of America, who now produce and distribute the device, at cost, nationally and internationally. In the 1970s, the American Printing House for the Blind also began producing and distributing a light probe designed for specific application. APH originally obtained the prototype from Lawrence Hall of Science (University of California, Berkeley), where the light probe in a square case had been developed for use by blind science students. To fit the needs of science students even more closely, APH modified the probe by adding the external characteristics of the present model — a square stainless steel case — to protect the inner circuitry against rigorous classroom use and to provide extra weight so that the probe could be situated at angles on inclined surfaces for various experiments involving light. The addition of four rubber feet also assists in holding the probe in position.

Finally has come the all-purpose light probe developed at the Smith-Kettlewell Institute. It is the smallest available light probe; the 9-volt battery which powers it accounts for most of the probe's bulk. Together with its portability, it is unique because of its sensitivity control and because of its capacity for use in either passive or active mode without the need even for turning a switch. William Gerrey, who developed the prototype had wanted the probe to come out exactly on the 100th anniversary of the light probe's invention. Missing the deadline by just a year, the San Francisco Lighthouse began manufacture and distribution of the Smith-Kettlewell probe in 1980. Reportedly, 1200 units have been sold.

Manufacturers concerned with providing sensory aids to the blind have continued to refine and modify the probe to fit the specific needs of a range of consumers, and the light probe has continued to sell, as suggested even by the sales of the Smith-Kettlewell probe by the San Francisco Lighthouse. The persistence and development of this simple electronic device is perhaps surprising, given that sophisticated electronic devices have become commonplace even in daily life. In this day of electronically synthesized speech, it might be expected that the mere indication of illumination or light and dark surfaces would no longer be important, that speaking devices would be able to sense and to verbalize all the information needed. Yet the marketing history of the light probe suggests its indispensibility for the simple but essential tasks of gathering quickly, in one immediate step, the essential information about lights or the colorations of surfaces. Like the survey of the light probe's applications, the history of the light probe's development illustrates its simplicity and adaptability, characteristics which underscore its unexplored potential even in this era of sophisticated electronics.

BIBLIOGRAPHY

"Dark Probe," *Vocational and Educational Aids.* San Francisco: Rehabilitation Engineering Center, Smith-Kettlewell Institute of Visual Sciences, January, 1982, p. 10.

Full description and photo of light sensor designed to monitor a switchboard and indicate when a call has been terminated. Schematics are available from the Smith-Kettlewell Institute at above address.

Dearing, L.M., and Eugene F. Murphy, "Dearing Light-Sensing Typhlocane-Model LST-3: Recommendations for Evaluation by the Veterans Administration," *Evaluations of Sensory Aids for the Visually Handicapped.* Washington, D.C.: National Academy of Sciences, 1972, pp. 95-100.

Describes potential, innovative application of light sensor at tip of long cane to enable the mobile blind to find and follow the white or yellow pedestrian-crosswalk lines at street crossings.

Etherton, Janet L., "A Visually Impaired Person's Comments on Employment." *Journal of Visual Impairment and Blindness,* Vol. 74, No. 9, November 1980, pp. 359-361.

In her section "Aids that Do (or Would) Make My Job Easier," the author discusses her vocational use of the light probe, listing the specific applications.

Guerty, John, et al. *Tools, Equipment and Machinery Adapted for the Vocational Education and Employment of Handicapped People.* Madison: Wisconsin Vocational Studies Center, University of Wisconsin, January, 1981.

Hadary, Doris E., *Laboratory Science and Art for Blind, Deaf, and Emotionally Disturbed Children: A Mainstreaming Approach.* Baltimore: University Park Press 1978.

Contains photographs and description of the light sensor being used by blind children in exploring various scientific concepts.

"Light Probes" (unsigned article), *Smith-Kettlewell Technical File: A Quarterly Technical Journal for Blind and Visually Impaired Readers,* Vol. 3, Fall 1982, No. 4, p. 31.

Brief directions for homemade light probes and brief discussion of relative advantages of some components. Written for the technically knowledgeable.

"Passive/Active light probes," *Annual Report of Progress: Rehabilitation Engineering Center of the Smith-Kettlewell Institute of Visual Sciences,* April 1978 — March 1979.

Definition of the light probe, lists of common uses.

Sensory Aids Foundation, *Sensory Aids for Employment of Blind and Visually Impaired Persons: A Resource Guide.* New York: American Foundation for the Blind, 1978.

Contains descriptions of and sources for light probes, some of which are now out of date. See especially "Introduction to the Employment Area Index" (p. 179) and "The Employment Area Index" which follows, for vocational applications of the light probe (as well as other sensory aids).

Wexler, A., *Experimental Science for the Blind: An Instruction Manual.* London: Royal National Institute for the Blind, 1962.

Contains circuit diagram for homemade light probe as well as history on early uses of the light probe in exploring scientific concepts.

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VOICE OUTPUT FOR COMPUTER ACCESS BY THE BLIND AND VISUALLY IMPAIRED

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AAR IS AVAILABLE ON TAPE IN LIBRARY OF CONGRESS FORMAT. FOR A TAPED COPY, SEND ONE C-90 BLANK CASSETTE TO THE AAR EDITORIAL OFFICE AT THE ADDRESS ABOVE. SPECIFY ISSUE REQUESTED.

EDITORS' NOTE

"Computer Access through Voice Output" is the first double issue of *Aids and Appliances Review.* With the intention of providing a thorough coverage of the hardware, software, and applications of voice output from computers, our original goal was to focus the summer issue on hardware while concentrating the fall issue on software and applications. In compiling the research for both issues, however, we came to realize that such categorization violated the integrity of what was truly a single, though complex, topic. Of necessity we have split off braille output from the larger topic of computer access for the blind and will publish that material as Issue No. 11 of AAR.

The application of speech synthesis technology to the production of voice output from computers is potentially a ground-breaking development in enhancing vocational and educational opportunities for the blind. The ability to obtain a "vocal display" rather than a "visual display" can enable blind and visually impaired persons to interact with computers in occupational, educational, or even home use on a par with their sighted counterparts.

For personal use, the microcomputer with voice output appears to have the potential to enhance communication opportunities for blind individuals. Public data bases which supply such information as the daily news, the stock market report, airline schedules, etc., can be accessed by a microcomputer over the telephone lines; with voice output capability the microcomputer speaks the information to the blind user. Likewise, a microcomputer equipped with software and a printer for word processing and a voice output module can enable the blind operator to type in a document -- a personal letter, a legal brief,or a term paper -- to hear it, to make revisions, to hear it again, and then to have a perfect copy printed for sighted friends, clients, or teachers. For such uses, the microcomputer with voice output capability can contribute greater efficiency, convenience, and enjoyment to communications tasks, and blind consumers, like their sighted counterparts, may choose to purchase such equipment for home or office.

But as computers more and more become an integral tool in the workplace and the school, use of a computer is no longer even a matter of choice. As Dr. Lawrence Scadden points out in the introductory article, forecasters predict that by the year 1990, 75% of all jobs will require use of a computer terminal.It is this phenomenon that makes access to computers by the blind population of paramount importance, and voice output capability provides one avenue of access.

In this Issue

This issue of AAR represents our first venture into reviewing high technology products. We have attempted to demystify the topic and to describe the devices without adopting too heavily the jargon of computer technology. We have also provided a glossary of terms at the end of this issue. Yet the reader may still feel intimidated by the subject, and our discussions may not be as clear as we have hoped. For more background on microcomputers, how they work and what they can do, for diagrams and explanations of terms, we recommend the September 1983 issue of Consumer Reports with its comprehensive article" Computers: Should You Take One into Your Home?" We also urge those unfamiliar with computer terminology to first read the glossary concluding this issue.

The accelerated development of computer equipment is almost legendary, and the resources for computer access through voice output are no exception. Because of rapid changes in computer technology, affecting both hardware and software, we realize that by the time this issue is distributed our information will be dated. Further, not all the resources presented here have been evaluated to their full extent. Therefore, whether or not they will meet all user requirements has not been determined. As a result we caution the reader to take our publication as an introduction to the field of voice output devices and to search on his or her own for information about additions, changes, and improvements in the products, prior to selection.

For organizational purposes in this issue, we have categorized the resources for computer access through voice output into six types:

Voice Output Modules (Speech Synthesizers)
Speech Adaptors (Speech Synthesizers with Integrated Software for Review)
Terminals with Voice Output (Talking Terminals)
Microcomputers with Voice Output (Talking Micro-computer Systems)
Time Sharing Systems (Time Sharing System with Talking Terminal)
Educational Work Station for Visually Impaired Students (A collection of voice and braille output devices connected to a microcomputer)

Each of the categories comprises a separate section in which the individual devices are described, and concluding each section is a chart of the specific features offered by each device. Preceding these discussions of the resources are four articles, selected by us or written specifically for the review to delineate some of the important considerations in making a selection of an adaptive device. And following these discussions is a section on job placements introduced by an article detailing some of the occupational effects of a talking microcomputer on the lives of three blind persons.

Acknowledgments

The following review is a product of the collaborative effort of a number of persons who have either designed or used voice output for computer access, and we are very grateful for their contributions.

Rachel E. Rosenbaum, Executive Director of The Carroll Center for the Blind, directed the research and editing of this issue, and Robert A. J. Gildea provided editorial and technical advice throughout the preparations. Mr. Gildea is a senior technical staff member of Mitre Corporation, Bedford, Massachusetts, with special expertise in systems engineering, in particular telecommunications systems with embedded computers. He holds an M.S. in Applied Mathematics from Brown University and a B.S. degree in Physics from Boston College. His numerous professional affiliations include the Association for Computing Machinery, committees on Computers and the Visually Handicapped,and several microcomputer societies. In addition, he is a member of the Board of Directors of The Carroll Center for the Blind and chairman of the committee on employment of the newly blind.

Author of "Words to Work By" in this issue, Eliot I. Friedman is President and Director of Engineering at Cyberon Corporation. Mr. Friedman attended the University of Michigan where he received a BSEE in 1969 and a MSEE in 1973. His Master's work concentrated on Bio-Electrical Sciences.

Mr. Friedman is totally blind as a result of long-term juvenile insulin-dependent diabetes. Besides his management duties he also is responsible for quotation and proposal writing as well as circuit design and computerprogramming in both high level and assembler languages.

Author of "How to Select a Talking Terminal," Mr. Ronald Morford is President of Automated Functions. Mr. Morford attended Pennsylvania State University, where he received his undergraduate degree, and American University, where he earned a Master's degree and was named a Distinguished Alumnus of 1980. Mr. Morford's visual loss was due to Morfan's syndrome. Previous to his present position, Mr. Morford had been a senior computer specialist with the Drug Enforcement Administration in Washington, D.C. since 1972.

Dr. Lawrence Scadden contributed both the introductory article, "Microcomputers in the Lives

of Blind People," and "Speech Synthesizers." He is Program Director for Science and Technology to Aid the Handicapped in the Division of Electrical, Computer and Systems Engineering of the National Science Foundation. He is also President of Rehabilitative Technology, Inc., a consulting firm for developing new strategies for the application and dissemination of needed technology. Dr. Scadden earned an A.B. in Government from the University of the Redlands, an M.S. in Psychology from the University of the Pacific, and a Ph.D. in Visual Sciences from the University of the Pacific Graduate School of Medical Sciences. Dr. Scadden uses both braille and voice output displays for both his work and hobby activities. Previous to his present positions, he spent eleven years at the Smith-Kettlewell Institute of Visual Sciences in San Francisco in research related to sensory aids for the blind and visually impaired people.

"Talking Products Enhancing Career Opportunities for Blind People" is jointly authored by Michael Mason, Vice President, Marketing, at Maryland Computer Services, Inc. and by John M. Williams, a freelance writer who has also written about users of voice output equipment for publication in popular magazines, notably an April 1983 issue of People Magazine which featured Mr. Williams's article on Judge Leonard Suchanek of Government Services Administration, Washington, D.C.

We would also like to thank a host of other persons who made contributions to this issue. From Dr. John M. Gill of the Institute for Bioengineering, Brunel University, Uxbridge, Middlesex, England, we received a current and complete listing of synthetic speech devices; Dr. Gill's list of products, vendors, addresses, prices and descriptions guided us in our research throughout this project. Judy Gerber of Baruch College Computer Center for the Visually Impaired in New York augmented Dr. Gill's list with a timely phone call to the AAR Editorial Office. The contribution of Harvey Lauer and Leonard Mowinski of the Hines V. A. Hospital in Hines, Illinois, was particuarly significant. They not only sent us a listing of products, people to contact,and phone numbers but also several pages of detailed comparisons among the available devices. Mr. Lauer uses a microcomputer with simultaneous voice and braille output and serves as a source of computer access information for persons who are blind and visually impaired. And we would also like to thank Miss Helen M. Townley of D.E.A.R.S., Kent, England. Miss Townley's organization-- Disablement, Electronic Aids, Reference Service -- maintains a central record of "new technology" aids developed in the United Kingdom, and she brought to our attention voice output resources available there.

Finally, we are grateful to the many users and designers who answered countless surveys, returned phone calls, and supplied product literature or shared personal experience: David Holladay of Raised Dot Company; William Grimm of Computer Aids; Ron Hutchinson of CompuTalkSystems; Dick Gage of IBM; Russell Thielman of Intex; Ron Struthers of AEON; Peter Duran of Arts Associates; Dr. Kenneth Ingham of Jupiter Technology; Dr. Thomas Vincent, Director, Computing and the Blind Project, The Open University, Manchester, England; Kerri Frey, Communications Instructor, of The Carroll Center for the Blind; Phillip J. Davis, Rehabilitation Engineer, Massachusetts Commission for the Blind; Barbara Silver of Vision Foundation; Francis Daniels of The Braille Institute; and Dr. Jeanette P.Sharp, Dr. Robert Bohrer, John Stevenson, and Fred Wurtzel.

AAR extends special gratitude to Mrs. Barbara de Castro who served as final reader for this issue as she has for each previous issue. Her painstaking attention to the text and her intelligent suggestions guided the final polishing of the manuscript, and her care rendered it much better than it would have been otherwise.

COMPUTER ACCESS THROUGH VOICE OUTPUT

Articles

Microcomputers in the Lives of Blind People

by

Lawrence A. Scadden

Social and economic forecasters are continually referring to the present transition between the industrial and the information society and between an economy based upon manufacturing and one based upon the creation, processing, and distribution of information. Even the casual observer will note the accelerating change in the form in which the information of today is displayed, the change from the printed page to the ubiquitous television-like video screen. The microprocessor "chip" -- the central component in computers, computer controlled appliances, and video games -- is revolutionizing our lives.

We, who are blind or who are dedicated to the delivery of services to blind and visually impaired people, must accept the fact that the current information explosion and technological revolution have brought us to an important crossroad, perhaps the most important in the history of education and rehabilitation of blind people. Sensory aid technology can provide virtual equality to blind and visually impaired individuals with their sighted peers within the emerging information society, With the aid of the appropriate technological devices, blind and visually impaired persons can independently access, process, store, and transmit the same information handled by sighted people. Both groups use microcomputers to manipulate the information. The only difference lies in the form in which the information is displayed -- on a video screen, in regular print, large print, braille, or synthetic speech. The computer has neither preferences nor prejudices.

On the other hand, if we fail to provide the appropriate sensory aid technology to blind people and thus restrict their full participation in the information society, we will in fact increase the gap existing between them and their sighted counterparts because the vast proportion of employment, education, and daily living activities of the future will require access to electronic information.

Recent furturistic literature -- Naisbitt's *MEGATRENDS*, Deken's *THE ELECTRONIC COTTAGE*, and Toffler's *THE THIRD WAVE*, among others--contains a multitude of citations documenting the significant role to be played by the personal computer in the years to come. Today, for example, only 13% of the nation's labor force is engaged in manufacturing activities while over 60% work with information. Although forecasters differ, predictions range as high as 75% for jobs which will require use of a computer terminal by the year 1990. Also, by that year, it is estimated that a minimum of fifteen million jobs in the country could be performed from home using a computer and a telephone line for data transmission. In education, it is estimated that half of the educational activities in the year 2000 will take place off campus, primarily through the use of interactive computers.

Within the home, the microcomputer is already becoming a very valuable aid for many people, especially blind people. A microcomputer can be used to access many publicly available data banks in order to obtain daily current events, stock quotations, weather information, or to research a topic of interest through the use of available encyclopedic resources. For the first time ever, blind people, using microcomputers and sensory aids, can have immediate, independent access to such information. The information available through this medium will continue to expand in the future. Richard Simmons, President of the Washington Post Company, says that, "Communications companies that establish a leadership role in the next five years, the ones that best adapt to new technology, will become the dominant suppliers of information services."

Expanded employment opportunities alone should provide blind and visually impaired individuals sufficient reason and motivation to familiarize themselves with the basics of interacting with microcomputers. Numerous jobs can and will be performed in offices and from homes by blind people using microcomputers and sensory and display devices. These jobs include the following.

(1) Clerical positions of all kinds--word processing, filing, transcription, and form writing--can be performed with the use of microcomputers, sensory aids, and specialized software. In a word-processing setting, it is essential that the software permit the blind user to review the screen charac-

ter by character and to have the ability to determine the location of the "cursor," the indicator of where in the text the next character will be entered.

(2) Telephone expeditor positions are expanding rapidly, and the vast majority of these individuals require the use of a computer for accessing information and for data entry. Formerly, within the rehabilitation field, people thought of government agencies such as the Internal Revenue Service and the Social Security Administration as the only source for such positions. Now, telephone expeditors are employed to make reservations for transportation and lodging, take sales orders, check inventories and credit references, provide customer service for banks and utilities, and provide many other services for businesses and for the public.

(3) Bookkeeping and accounting can also be performed by blind individuals with appropriate technology. Although the software is still not ideal, such activities are currently being performed by a number of skilled blind people.

(4) Self employment, or participation in another's small enterprise, can provide business opportunities such as expanded message receiving and delivery service (the telephone answering services of tomorrow), computer mass mailing, remote printing service, and the forementioned clerical, word-processing, and accounting services.

(5) Managerial positions will also use computers. Executives and other white-collar workers of today are putting aside yesterday's stigma and are beginning to use the typewriter and computer keyboard as they find increased efficiency and enhanced productivity with the aid of instantaneously accessible electronic information.

(6) Computer related vocations such as programmer and systems analyst will, of course, flourish for some time. They already must be listed among those jobs which can be and are performed remotely, such as from home. It should also be mentioned here that there is and will continue to be a great need for specialized software development to meet the unique needs of blind and visually impaired computer users which are encountered daily in employment, education, daily living, and recreational settings.

One major cause for the large gap existing between the number of people, both blind and sighted, who use microcomputers and those who could significantly profit from their use is that of the widespread intimidation felt, primarily by adults, toward computers. The myth continues to prevail which suggests that one must have esoteric, technical, or programming skills in order to operate computers. Computers, however, are becoming more and more helpful, or "friendly," to the user as the software programs provide prompts, instructions, and questions which lead the user step by step from operation to operation.

An analogy has been made between the computer and the automobile. Many, if not most, drivers safely operate the automobile without the slightest understanding of the workings of the internal combustion engine. An adequate familiarization with the controls and sufficient practice provide the new driver with the skills and confidence necessary for independent operation of avehicle, thus significantly increasing one's mobility.

Similarly, with the computer, an adequate familiarization with the controls and sufficient practice will provide the user with the skills and confidence necessary to perform functions which will significantly increase productivity, efficiency, and, for blind people, independence. With the computer, however, unlike the automobile, poor timing or the pressing of the wrong control cannot lead to bodily harm.

Material is being presented for the purpose of providing information regarding the options that are available among sensory aid display technology with the objective of encouraging more people to take advantage of the expanding opportunities provided within the age of electronic information.

How to Select a Talking Terminal

by

Ronald A. Morford

Editors' Note: ***What is stated about terminals is equally applicable to microcomputers with voice output and speech adaptors.***

The selection of a talking computer terminal that meets your needs today and in the future is not an easy task. Ordinarily interacting with a computer depends on a video display screen which monitors the material entered, produced, or retrieved. The material on a video display screen is two-dimensional and static, a format which allows the sighted user to scan and to select the appropriate information and to review it repeatedly for analysis and comprehension when desired. But unlike visual display, speech is a serial medium. Once the word is spoken, it is gone. One may think of a talking computer terminal as a one word window viewing the computer's activities. Every time a word is spoken, it appears in the window. Because only one-word is present at a time, the scanning and selection process available with sight is not possible. This serial medium means that the talking terminal must have the proper functions for review to inform the blind user what he needs to know. Spoken output alone does not enable the blind user to interact with the computer. The other functions of the talking terminal must be sufficient to allow the user to manipulate the verbal window to meet his needs in interacting with the computer.

To select a talking terminal, one must articulate a set of requirementsfor the specific job and user. The requirements may be thought of in two categories:

* Mandatory Requirements
* Desirable Functions

The Mandatory Requirements are those which absolutely must be met inorder for the user to perform the job at the minimum level. If all of theMandatory Requirements are not met, the talking terminal is not considered. The Desirable Functions are those which save time and add ease of use,capability, and accuracy. The Desirable Functions are extremely important sincethey contribute to the eventual increase in productivity of the user.

The Mandatory Requirements for a talking computer terminal will givethe user the following abilities:

1. Ability to hear the data as it is typed.
2. Ability to listen to text accessed without data loss.
3. Ability to review text.

(1) Ability to Hear the Data As It Is Typed

During input, the talking terminal must be able to immediatelyverbalize either the letters or words as they are typed. If the user cannot hear what he is typing, errors are likely to be undetected.

(2) Ability to Listen to Text Without Data Loss

The talking terminal must be able to connect to a remote computer. The user must be able to request text and be able to listen to it as it is being sent from the computer without data loss. If data is lost while the terminalis talking, the user becomes extremely frustrated and confused, and, most important, may not be able to perform her job properly. The talking terminal must have a combination of a buffer memory local to the user's terminal, and a communications protocol to store with fidelity sufficient information for there view function.

(3) Ability to Review Text

The user must have a way to review the text. The unit must allow the user to review lines, words, and letters. The unit must permit the user to skip back to previous material or skip forward to any desired position in text.This review capability is necessary to clarify mispronounced words and to review material which was not understood.

Desirable Functions

The Desirable Functions for a talking terminal depend on the specific job. In general, the more functions a talking terminal has, the greater chance the user can utilize the functions to save time and be more efficient. The following is a list of Desirable Functions and a description of why they are useful. The ordering is from most desirable (closest to mandatory) to less desirable. However, the potential consumer's priorities may differ. A specificjob may call for some desirable function to be placed higher on his or her priority list than on the list offered here. The price of the talking terminal is also a factor in decision making. Most talking terminals which satisfy the Mandatory Requirements cost between $4,500 and $6000. But the difference in price is outweighed by how closely the Desirable Functions meet the needs of the specific job and user. The person(s) selecting the talking terminal must decide which Desirable Functions are most important to the specific job and user.

Table I. - List of Desirable Functions

* Can instantly stop the voice on a word
* Minimizes hand movement when reviewing text
* Verbally announces error corrections
* Can adjust speech rate
* Provides sizeable Review Memory
* Verbalizes punctuation and special symbols
* Distinguishes between upper and lower case letters
* Identifies column
* Can automatically spell unusual letter combinations
* Synchronizes Print/Voice
* Can expand letters to phonetic equivalent
* Can mark text for review
* Can skim read
* Can search memory
* Can say numbers as words
* Can supply personalized vocabulary
* Can redefine keyboard
* Can traverse tables
* Can pronounce nonprintable computer characters
* Can suppress repetitious characters
* Provides for Off-line preparation

Description of Desirable Functions

* Can instantly stop the voice on a word

Talking terminals create their speech by using English rules of pronunciation. Since they sometimes mispronounce words, it is important to be able to stop the voice on a specific word. Once the voice is stopped, the user must have a way to verify or clarify the mispronunciation. This is accomplished through the review functions. If the user must wait until the transmission from the computer is complete, it breaks the train of thought and greatly aids in frustration. The instant stop capability permits instant verification of the text.

* Minimizes hand movement when reviewing text

If the review functions are located on the regular keyboard, the user never has to remove his hands to review text. If the reviewing is accomplished with a keypad located to the side or on top of the keyboard, extra hand motion is needed. This hand motion may cause more errors since one is always moving his hands from the regular keyboard. It also takes more time, since the home row keys must be found after the blind user has moved his hands off them.

* Verbally announces error corrections

This function permits the blind user to hear the corrections of typing errors. When the user is entering text to the computer, the backspace key erases the last letter typed. This function should cause the talking terminal to verbalize the letter that was erased. It is also beneficial if the user can verbally correct the input line before sending it to the computer.

* Can adjust speech rate

With practice, synthetic speech can be understood at rates up to 400 words per minute. If the speech rate can be easily adjusted, it aids in more rapid interactions with the computer. The pitch of the voice should not change when the speed is increased.

* Provides sizeable review memory

The talking terminal should have at least one page (24 lines) of review memory. In general, the larger the review memory the better. If the data is in the review memory the user does not have to request the information again from the remote computer and this saves time. It is also helpful for quickly gaining information from the computer and then disconnecting. This may save money if you are billed for time of connection.

* Verbalizes punctuation and symbols

The talking terminal should be able to verbalize or suppress punctuation and symbols, and the control should be capable of quick activation. For example, computer programmers need to hear all punctuation and symbols, but a user listening to a memo may not want to hear them.

* Distinguishes between upper and lower case letters

Can the talking terminal distinguish between 'A' and 'a'? This capability is needed in document correction and creation. It is also helpful in some computer programming.

* Identifies column

This function is helpful for setting up columns and writing computer programs. Many computer programming languages (e.g., Cobol and Fortran), make the user place text in certain columns. It is helpful if the talking terminal can announce the current column. The talking terminal should also be able to announce the column location in review mode. This function aids in computer programming and word processing.

*** Can automatically spell unusual letter combinations**

This function allows unusual words such as abbreviations and computer programming variables to be spelled. This function minimizes the need to review words which may sound unusual. Words with all vowels or all consonants should always be spelled. Most often a string of all vowels or all consonants is not an English word but rather a series of initials; for clarification the user may wish to have them spelled.

*** Synchronizes Print/Voice**

This function allows the print to appear on the display as it is spoken. This is extremely helpful to a sighted person assisting the blind user.As the sighted person sees the word, the blind person hears it.

*** Can expand letters to phonetic equivalent**

Phonetic expansion is important when listening to letters out of context. For example, the talking terminal may verbalize the word 'BRAVO' for'B' and the word 'DELTA' for 'D'. If this function is not available, sighted assistance may be required to distinguish letters out of context; for instance there are 9 letters in the English language with the 'e' sound which may not be distinguished.

*** Can mark text for review**

This function is analogous to highlighting printed text with a magic marker. The talking terminal should be able to mark many different areas of its review memory. The user then may return to any of the marked locations. This is extremely beneficial, since voice is a serial medium (one word at a time).

*** Can skim read**

Skim reading allows the user to listen to selected amounts of a line,then skim ahead to the next line. This function is helpful in locating important areas of text. One need only listen to as much of the line as desired or required. This function is helpful to all professions.

*** Can search memory**

This function allows the user to search the review memory for a string of characters, permitting rapid location of text in the review memory. The sighted can visually search through large amounts of text. This function permits the talking terminal to perform a similar function for the blind user.

*** Can say numbers as words**

This function allows the talking terminal to pronounce a sequence of numbers as words. For example, 100 is pronounced one hundred. The user must be able to quickly switch from digit-at-a-time mode to number-word mode.

*** Can supply personalized vocabulary**

This function allows the user to supply a personalized vocabulary. This is helpful in eliminating mispronounced words or abbreviations. For example, a user may inform the talking terminal that the abbreviation USA is to be pronounced United States of America. Many talking terminals will pronounce"USA" as "Use A". The function should be valid when typing the abbreviation,reviewing text, or listening from the remote computer.

*** Can redefine keyboard**

This function allows the user to define the punctuation and symbols on the keyboard. For example, the user may inform the talking terminal that the"(" is to be pronounced "LP" and not "Left Paren". This function also allows the user to define which punctuation and symbols are not to be pronounced.

*** Can traverse tables**

This function permits the talking terminal to go straight up or down columns. This is helpful if the job requires any use of tables.

*** Can pronounce nonprintable computer characters**

The computer may transmit codes which do not print on the display screen. This function allows these non printable characters to be verbalized.

*** Can suppress repetitious characters**

This function permits the user to skim over error messages such as ********* Error *********. The voice turns off until the repetitious characters are finished.

*** Provides off-line preparation**

This function allows text to be input directly to the terminal. The user then connects to the computer and transfers the text to the computer. This saves connect time which is often expensive.

SUMMARY

Today many devices have the capability to speak. It is a difficult task to select a talking terminal which meets a blind person's job requirements today and in the future. The Mandatory Requirements are those which must be met to perform the job at the minimum level. The Desirable Functions are those which aid in increasing productivity. A talking terminal which satisfies the Mandatory Requirements and most of the Desirable Functions will produce an environment which can maximize the blind user's productivity.

Speech Synthesizers

by

Lawrence A. Scadden

A number of relatively inexpensive speech synthesizers are currently on the market with additional ones appearing regularly. These modules can, if appropriately matched with microcomputers and driven with specially developed software, provide the blind user with enhanced employment, educational opportunities, and daily living activity with independent functioning. Even without specially developed software, some of these speech synthesizers can be used for certain applications. Yet it should be emphasized at the outset that the user cannot expect to obtain the same flexibility provided by the larger, more versatile, but more expensive, speech equipment. These larger speech systems are most appropriate when interfacing is required with existing computer equipment other than the microcomputer.

Today, the speech synthesizers most commonly used by blind people with microcomputers are the Street Electronics Echo GP and Echo II, the Votrax Type-and-Talk, and the Votrax Personal Speech System. Other speech synthesizers of note include the Texas Instruments Speech System, the Intex Talker, the MicroMint Microvox, the Alien Group VoiceBox, and the Sam. Each of these modules is under $400.00.

Selection Criteria

When deliberating the purchase and use of one of these speech synthesizers, the consumer should consider two sets of factors. One set of factors relates to the consumer's needs: desired common use of the computer, microcomputer to be used, need for CRT screen review in the computer's application, need for cursor control feedback. The last two functions -- CRT screen review and cursor control feedback -- will be capabilities of the software running in the host microcomputer; the software can be either unmodified software or adaptive software, designed especially to work with a voice output module and provide for review and cursor control feedback. The other set of factors involves considerations related to the speech synthesizer: can it provide good voice quality and is adaptive software available commercially to provide these review features if needed and not provided in the original system. In addition, whether there is software available to provide for speech output along with specific applications needs to be explored. In the resource guide which follows this article, resources for this kind of software are listed after the resources for the speech synthesis hardware.

One of the criteria for selection -- availability of adaptive software -- merits further explanation. Without software to provide for CRT screen review and cursor control feedback, the user is restricted to listening to text as it is spoken by the speech unit which simply voices all the text appearing on the CRT screen in a linear progression. Consider a typical screen display on a common word processing system:

Your options are:
(1) Enter the word processing system
(2) Backup your diskettes
(3) Assign your system parameters
(4) Quit
Which is your choice? ________

When the menu above appears on the screen, the speech synthesizer would voice the four options above. But if one or two words sounded strange or unclear in (2) or (3) or if the user forgot the sequence of what he heard, he would need a means of review. Without the ability to select specific lines to hear again, it can be difficult for the user to choose the number to enter. Interaction with the computer has not really been facilitated by speech synthesis.

However, in many instances, such as listening to files or data service information, listening to the text as it is spoken can be adequate. It is clear that the suitability of a speech synthesizer is largely determined by the use to which the computer is put.

Comparative Survey

Briefly, although new applications oriented software appears all the time making it virtually impossible to have a fully current status report, the synthesizers available at this writing can be described as follows.

The Echo GP and Echo II speech synthesizers generally are considered to lack high quality speech, but their versatility and available software greatly improve their desirability. The Echo II has been designed to work as an integral part of the Apple microcomputers. This feature permits Apple users to use the system as if it were a CRT screen; however, to provide for adequate speech production, the speech synthesizer subtracts a significant amount of usable memory.

The Echo GP is also being used with specially developed software with the Osborne personal computer. This software provides the user with full screen review and cursor control capability.

The Votrax Type-and-Talk is being used with the Apple, the Radio Shack TRS-80, and the Lobo Max-80 microcomputers with specialized software which permit the user to have full control over review and editing activities.

The Texas Instruments speech synthesizer is being used with the Texas Instruments microcomputer, but at this time, only text display is permitted.

The Alien Group VoiceBox utilizes a fixed vocabulary programmed into the Apple or Atari microcomputers. This provides quality speech, but the limited vocabulary reduces the value of the system for specialized applications of blind users.

The Intex Talker and the Votrax Personal Speech System both have significant speech versatility for programming such things as inflection, but they lack software at this point adequate for initiating such features as screen review, cursor control feedback, spelled speech mode, and punctuation enunciations. Such needed software is expected for these systems for several microcomputers in the near future.

Both the MicroMint MicroVox and the Sam could provide blind users with high quality speech displays; however, at this time, adequate software is lacking which would provide the blind user with the flexibility needed for typical applications.

In the computer field no discussion can be the "state-of-the-art" for very long. Without question, other application software for some of these units must exist but has not as yet been disseminated widely enough. Even these few examples, which have appeared within the last five years, demonstrate that blind people will rapidly become equal to their sighted peers in the independent access to information.

Words to Work By
by
Eliot I. Friedman

Introduction

Utilizing the ordinary typewriter, transcription from dictation to the printed page has become a traditional vocation for visually impaired people. The typewriter, however, is rapidly being supplanted by the electronic word processor. While these micro-electronic systems offer the increased production abilities of electronic editing, revising, adding to, and/or removal from the original text, they require the ability to access the information available on their video screens. This at once seems to present a problem for the visually impaired potential word processor operator. The same technology that has made the word processor possible, however, also can provide a solution to this new problem.

Devices are available for accessing computers by means of either braille or speech. Braille presents another set of problems such as the need for two cells to indicate upper case letters. The focus of this article has been word processing utilizing electronically synthesized speech.

The requirements for equipment which would make this type of vocation open to the visually impaired can be likened to having a sighted reader looking over one's shoulder. The information available on the screen must be available to the blind user, as well. The electronic device must have the ability to selectively provide the information necessary while skipping that which is, at the moment, superfluous. Information such as the case of letters, the punctuation, abbreviations, correct spelling, etc., are mandatory for efficient usage of a word processor. There should also be a means to review easily.

The command system of the speech device should be easy to use and not interfere with the operation of the host device, itself. The equipment must, of course, be able to be interfaced, and the host device must supply all of the necessary information over its communications port.

Various types of speech synthesis equipment are available. They range in price from a few hundred dollars to several thousands of dollars. In general, the units at the low end of this scale do not provide the information necessary for vocational usage. The rest of the equipment falls mainly into two groups: terminals or personal computers with built-in speech and speech adapters to be used with existing terminals. The choice of which to use is dependent on the host device.

Technology is currently adequate to allow the smooth transition from the ordinary typewriter to the word processor or electronic typewriter for the visually impaired. Equipment with the necessary functions is available but the selection process must be done carefully.

Access to Word Processing via Speech Synthesis

The ideal solution to the problem of access to word processing by visually impaired users would be to have a sighted person looking over their shoulder. This "reader" would be able to answer any question the person doing the word processing might have. The reader could be asked to provide only the information necessary at the moment to improve efficiency. Utilizing the selection process that is part of normal vision, the reader would disregard that information which was superfluous at the moment. An intelligent person would be desirable for the reading job since this would simplify the instructions the visually impaired person would have to give. The fewer the instructions, the higher the productivity.

The next best solution would be an electronic method of acquiring this information. Speech would be simplest since it is faster than braille and allows input through a normal keyboard. The synthesized speech device should also be able to synthesize the interaction between the user and an intelligent human reader. Thus after receiving a minimum of instruction it should be capable of delivering the information needed in a clearly understandable voice.The electronic method should be capable, like the human, of ignoring that which is currently unnecessary while delivering the information desired.

What, then, is this information necessary to the user of a word processor? The requirements are somewhat different from that of data processing or "number crunching." It is imperative, for example, to know the case of letters. Proper names, the first letter of a sentence, etc., must be capitalized. There are, however, times when the inclusion of this information would be unnecessarily time-consuming. A fast reading might be desirable for checking content. Under these circumstances a human reader would be ignoring the case of the letters; the electronic reader should be capable of doing the same. Furthermore, the method of informing the user of an upper case letter should be as clear yet time efficient as possible. There should be no confusion between the message that a letter is upper case and the text material itself.

Another important component of text is punctuation. Certainly a character by character reading of text could supply this informtion, but this would be terribly time-consuming. Like the human reader, the electronic version must be able to provide rapid access to the text with the punctution information. This requires the ability to read words while inserting the punctuation, when it is desired. Some forms of punctuation, however, must always be verbalized to avoid changing the context of material. The "equals" sign (=) and the "ampersand" (&) are just two examples of punctuation that must always be verbalized.

There are other features which the human reader handles automatically that would make the electronic reader even more useful. The human reader, for example, automatically substitutes the entire word for abbreviations. Example: "incorporated for Inc." He also will format a string of numerals into hundreds, thousands, etc. The human reader can be asked to spell an unfamiliar word or name. And, most importantly, the human reader can repeat characters, words, lines, or entire sections of text at the user's request. The electronic reader should also be capable of performing these functions. In addition, the user can teach the human reader selective pronunciations for words unfamiliar to the reader. What's more, the human reader has what is known in the computer industry as "non-volatile memory." This means that it is at least semi-permanent. The electronic counterpart should be able to retain these special pronunciations even after power is turned off. These conveniences may seem nothing more than "bells and whistles" at first, but after actual usage of such a device it becomes apparent just how much more efficient they make the user.

Technically, the ability to review parts of or the entire text requires that the electronic reader have its own text buffer inventory and the ability to move about and read selected parts of it. The buffer should be large enough to store at least one screen full of information. The average screen consists of 24 to 40 rows of 80 columns each. This works out to somewhere between 2,000 and 3,200 characters. Larger buffers allow more of the document under development to be stored and recalled without requiring usage of the command system of the host device.

This brings up another important matter. As with the case of the human reader, the instructions to the reader should not interact with the commands to the word processor itself. Efficiency goes way down when special machinations are required to deliver instructions to the reader without giving erroneous commands to the host device. There must be a careful trade-off between this possible interaction and the ability of the electronic reader to supply the necessary information from the word processor in the first place.

Currently Available Equipment

Speech synthesizers have been available for a number of years. In today's market, units are available at prices ranging from a couple of hundred dollars to those costing up to $10,000. Just what is needed by the visually impaired prospective word processor depends on what type of word processing equipment is to be used. It is safe to say that, with few exceptions, the units selling for below $1,000 are not going to be equipped to supply the necessary information and interface with the commercial word processing equipment.

Units selling for prices in excess of $1,000 generally fall into two major groups: the terminals and the speech adapters. (In this issue of AAR, the speech adapters priced in excess of $1000.00 are termed "Peripheral Integrated Devices." See that section for further explanation.) There are advantages and disadvantages to both types of equipment. The major consideration is compatibility with the host device. In the case where the user sits at a remote "work station" connected to a large computer there may be room for choice between a terminal with built-in speech and an adapter that would add speech to an existing terminal. The primary consideration here is the compatibility of the terminal/synthesizer with the operating system of the host system. The adapter must be able to interface with the terminal, and the terminal must be transmitting all of the data the user needs to hear. The interface versatility and the possible interaction of the word processor/speech synthesizer control system must be carefully analyzed.

In the case of stand alone word processors, there may not be much choice. Generally the keyboard is part and parcel of the system. There may be no way to connect a substitute terminal with built-in speech. There may also be a problem in connecting a speech adapter to such a system. There must be a suitable port to which the adapter can interface. Furthermore, the necessary information regarding the text as well as the commands must be available at this port. It is possible in a number of cases.

A relative newcomer to this field is the electronic typewriter. These micro-computer based devices are available from a number of sources. The level of sophistication has increased to the point where these devices are almost as versatile as word processors themselves. Most of the electronic typewriters currently on the market are available with communications ports that will drive a speech adapter. Here it is most important to have totally independent control systems on the speech adapter since most of these typewriters are incapable of producing the non-printing control characters generally used to control those speech adapters which get their control signals on the data input lines.

RESOURCE GUIDE

Introduction

The computer market, especially at the microcomputer level, now resembles the stereo market of the 60's and early 70's . It is possible to purchase components from a number of supply houses and to build your own system. Basically a system consists of the following hardware: central processing unit (CPU) which also possesses electronic memory and the software of the operating system; input devices, usually a typewriter-like keyboard to type in data and commands; storage devices -- a disk drive or a cassette recorder -- and output devices; a printer, video display screen, and/or for the interests of our topic here, a voice output module. Also purchased separately is the software for the system, analogous to phonograph records, to provide for the applications of the computer, and they generally fall into five categories: word-processing programs, games, educational programs, electronic filing systems, and financial record-keeping programs. Within these categories, there is now software designed to be used with voice output, listed and described below in this section. (In larger businesses and universities software running in host computers is often customized for the particular needs of the firm or school, and many more and complex categories would be needed to begin to describe software at this level, a task well beyond the capabilities of this review.)

For the individual already familiar with the use of a computer, the do-it-yourself approach might be preferable, for it is possible to customize a system for home or professional office use by combining a brand-name microcomputer, with the selected voice output module, and the appropriate software for one's intended applications. As many options are possible as there are combinations of brand-name computers, software, and voice output modules. In the sections "Voice Output Modules" and "Software for Voice Output Modules and Microcomputer Interfaces," we have attempted to provide information useful to persons desiring to build their own systems.

Category	Voice Output Module
Main Function	Real-time speech output peripheral • will vocalize data as input to or displayed by existing computer equipment • small buffer momentarily stores data as it is vocalized
Review Functions	• depend on software in host system, either unmodified or software specially adapted for review via voice output
Purpose	For connection to Microcomputer or Terminal when voice output is desired from existing equipment

A few of the systems included in the section "Microcomputers with Voice Output" have been assembled by the vendor from commercially available brand-name computers and voice output modules, and they provide good examples of what can be accomplished by the do-it-yourself approach. The Talking Apple, which results from the Apple IIe or II+ interfaced with the Echo II; the AVOS, which results from the Osborne I and the Echo GP; the Talktex, which results from the VIC - 20 and the Echo GP; and the Texas Instruments Talking TI 994A, which consists of the TI home computer plus the TI voice synthesizer, are all examples of talking systems devised from assembling hardware components available on the market with programs (software) written to maximize the voice output capabilities of the device. However, we recognize that the majority of users will prefer to purchase voice output equipment in which all necessary components are sold in one bundle, and we hope to provide information in this guide that will enable

VOICE OUTPUT EQUIPMENT

In-line Speech Adaptor	Terminal with Voice Output	Microcomputer with Voice Output
Real-time speech output peripheral with extensive review capabilities • will vocalize data as input to or displayed by existing computer equipment • large buffer temporarily stores two to twenty screens of data that can be selectively vocalized for review • interacts between an existing terminal (with keyboard) and remote or host computer or with micro computer	All input/output functions of an unmodified computer terminal designed to interact with remote or host computer, including large mainframe • will vocalize data as input to or displayed from host system • large buffer temporarily stores from one to five screens of data that can be selectively vocalized for review.	All data processing functions of an unmodified microcomputer (home or personal office computer) with voice output. • will vocalize data as input or displayed • random access memory temporarily stores data input or read from permanent storage; voice output capability will speak data as input or displayed
• provided by larger buffer and software built into speech adaptor	• provided by built-in software in some models, dependent upon host software in other models.	• provided by built-in software, modified applications software, or unmodified software or any combination of the above.
For connection to Terminal or Microcomputer when voice output with extensive review capabilities is desired from existing equipment.	For operation in place of a conventional computer terminal when voice output with review capability is desired.	For operation in place of a conventional microcomputer when voice output with review capability is desired.

the potential consumer to select the equipment appropriate for the particular application. Following the sections "Voice Output Modules" and "Software for Voice Output Modules and Microcomputer Interface", the Resource Guide includes "In-Line Speech Adaptors," "Terminals with Voice Output," "Microcomputers with Voice Output," "Time Sharing System," and "Educational Work Station." Product descriptions and charts of product features in these sections attempt to provide information about the nature of the particular devices. The chart on this page is designed to show distinctions among four kinds of equipment: voice output modules, in-line speech adaptors, terminals with voice output, and microcomputers with voice output.

For further background, a summary of the characteristics of the six categories of voice output equipment may be helpful.

Briefly, the voice output modules contain a speech synthesizer (and a speaker), and must be connected to a host microcomputer or terminal for which it then provides voice output, as a printer so connected would provide output in ink print.

In-line speech adaptors also contain a speech synthesizer to provide voice output when connected to a terminal or microcomputer, but they also have larger buffers (larger storage capacity for the information from the computer) and integrated software which allows the user to have selected information repeated for review, in addition to providing other functions. They must be connected to either a terminal or a microcomputer. The software for applications will be contained in the host -- either in the computer accessed by the terminal or in the microcomputer if that is the host. Software to enable the speech adaptor to interface with a microcomputer is needed, and that is listed and described in the subsection following the discussion of speech adaptors.

Terminals with voice output offer all the capabilities of a terminal together with voice output from either an integrated speech synthesizer or an attached voice output module. As in the case of in-line speech adaptors, applications software will reside in the host computer accessed and will determine how the computer is used.

Microcomputers with voice output either have a speech synthesizer integrated or attached in the form of a voice output module, while maintaining all the data processing capabilities of the original, unmodified computer. Software designed to enhance the capabilities of microcomputers with voice output is listed after that section.

Both time sharing systems and work stations are a composite or particular configuration of any or all of the above kinds of equipment, and those sections should be consulted for more specific descriptions.

No hard-fast guidelines can be laid down to indicate which kind of equipment should be used for a given application or job placement, yet such direction can be useful. Therefore, with the understanding that there are no doubt countless exceptions to the following statements, we are going to relate the judgments of one rehabilitation engineer on placing voice output equipment. (In addition, the reader should consult the third section of this issue "Career Implications for Blind People" which lists existing job placements with the specific equipment.)

In-line Speech Adaptors are used often in heavy business applications where the job involves use of a company terminal, already in place, accessing a large mainframe. Terminals with voice output are often placed in a job where a user must access a large mainframe but where the company does not already have its own terminal. In general, the microcomputer with modular (attached) voice output is used for "light professional tasks": for word processing applications by students and professionals or for the work of a professional office involving word processing, electronic filing, and public data base access. Microcomputers with integrated voice output tend to be placed in larger agencies or businesses such as insurance companies and banks. With appropriate software they are also capable of acting as intelligent terminals to access the large mainframes typical of businesses with extensive computer systems, though it should be noted that many microcomputers with modular voice output, particularly the Apple and the Osborne, can also act as intelligent terminals with appropriate software.

In preparing this review, we have concentrated most heavily on describing the equipment while we have relegated limitations to a secondary concern. Of course, there are limitations and pitfalls, but many tend to lose their significance in comparison to the employment benefits gained or as the device is used. For instance, much has been written and discussed about voice quality. While researching this issue we spoke with a number of blind users across the country and have come to the conclusion from these discussions that voice quality tends to be a less significant criterion in the selection of voice output computer equipment. Most users become used to the computerized voice in a short time. Actually, selection is usually governed by application and cost.

Moreover, this first generation of machines has pitfalls and limitations which are shared by all and cannot be listed as a disadvantage of a specific brand or model, so we have instead listed some of these here:

- When connecting any of the components and systems described herein, care must be taken to insure that compatability exists between the two devices being interfaced. For example, most connections to a large IBM mainframe require protocol converters, additional devices with capabilities not described in this review.
- When accessing a large file from the host computer, the device's ability to store data (buffer) may not be sufficient, and the user will have an overflow problem.
- In the backspace mode, many devices cannot speak letters over which the cursor moves.
- Repairs on devices may be costly in terms of time if not money if a local engineer to help out is not available. Even with a warranty and service contract, most devices have to be

mailed back to the manufacturer for repair, a time consuming procedure.

Each section concludes with a characteristics chart comparing the features of the particular devices discussed. The charts are meant to be informative rather than evaluative. They are meant to show how individual devices within a given class differ rather than to suggest that one device is better than another. Some devices may have more features than another, yet those extra features may not be relevant for all applications. For example, a feature such as the ability to vocalize digits as their numerical equivalent (123 = one hundred twenty-three) may become significant only if the user works extensively with figures and would have to listen to $1,875.83 as "dollar sign - one - eight - seven - five - period - eight - three" followed by = $20,832.98 ; then having digits spoken individually could become confusing. Before selection, any device should undergo a "test drive," and its various features should be considered in the light of the application for which the computer will be used.

All of the equipment listed and described in the Resource Guide has one element in common -- a microprocessing "chip" which is programmed to actually produce speech. A speech chip consists of the all the essential electronic components needed to produce speech, unbelievably miniaturized, contained on a section of a wafer sliced from a crystal of silicon. For voice output capability, this chip is the essential ingredient in voice output modules, in-line speech adaptors, and terminals and microcomputers with voice output -- which may have achieved voice output capability by being interfaced with a voice output module that actually contains the speech chip. The explanation of how this chip is programmed to produce speech suggests that, though it requires a great deal of language analysis and programming expertise, it is a comprehensible procedure. See inset on this page.

Speech Synthesis - How It Works
by
John M. Williams

A speech synthesizer is programmed to speak in much the same way a child is taught to speak phonetically. The speech is produced by a chip (or synthesizer board) which is capable of vocalizing the different phonemes (phonetic sounds such as th, sh, long and short vowels) of the English language.

A microprocessor converts letters and groups of letters into digital codes corresponding to these phonemes, employing English pronunciation rules such as when a vowel is pronounced long or short. For example, the silent e rule tells the microprocessor that an e followed by a space or punctuation, and preceded by a consonant, which in turn is preceded by one or more vowels, should be silent. The word care illustrates this rule. Approximately 400 such rules for pronunciation enable a speech synthesizer to produce intelligible full word speech.

VOICE OUTPUT MODULES

Products

ECHO II*
ECHO GP
INTEX TALKER
MICROVOX
VOTRAX TYPE 'N TALK
VOTRAX PERSONAL SPEECH SYSTEM

*Echo II has different physical characteristics but is enough like other units in **function** to be included here.

Classification: These devices can convert text normally appearing on a computer's video display screen into speech. They can attach to any microcomputer or terminal which has an RS232 serial port (or a parallel port) the connectors for which are usually located on the computer's rear panel. Internally, the computer sends its stream of ASCII code both to the video screen where print is displayed and to one of these ports through which the code is further transmitted to other devices. The voice output module is connected to the microcomputer or terminal at this port via a communications cable and serves in place of or in addition to a printer as the destination of the ASCII code. Upon receiving such ASCII data, the voice output module converts it to speech. The voice output module is said to operate in real time mode because it speaks the text as data is sent to the screen of the microcomputer or to the terminal and only as the data is sent.

All of these voice output modules (except the Echo II) have the same physical characteristics. The external box which connects to the host microcomputer or computer terminal houses the electronic circuitry programmed to translate the ASCII code into speech. The Echo II, also programmed for text-to-speech conversion, is a circuit board designed exclusively for the Apple IIe or Apple II+; it plugs into an interior slot of the Apple. For both boxes and the board, there are controls for such speech parameters as volume, rate, and pitch. Refer to chart.

All of the devices listed above possess the capability to enunciate punctuation and symbols as well as letters and words. The electronic circuitry is programmed to accept the ASCII code for letters and produce equivalent phoneme sounds, the sounds that compose words. Except for the Type 'N Talk, they are also capable of accepting the ASCII code for a "," a "." or a "( )" and ennunciating "comma", "period", or "left paren" and "right paren." The Type 'N Talk can pronounce punctuation and symbols thus only if specially designed software is running in the host computer.

Software Considerations

Software, as is explained more fully in the section "Software for the Voice Output Modules," is the computer program, the set of instructions directing the computer to perform certain functions. All computers will be running software that will fall into three different classes: operating systems, utility programs, and application programs. The operating system supervises the running of the other programs and controls the input and output functions of the computer. One of the most popular operating systems for microcomputers is the CP/M operating system. Application programs allow the user to put the computer to a specific use. For example, a word processing program allows the computer to be used like an electronic or memory typewriter on which all changes, insertions, and deletions may easily be made while the text is held in the computer's memory and displayed on the screen prior to printing; margins are automatically set, headings automatically centered, etc. Once the text is typed in and proofed, corrected, and automatically formatted, a single command causes a perfect document to be printed. Some of this software already in use in the host computer will be "friendly" to a voice output module, and some may not. A utility program directs the computer to perform some useful mechanical function such as copying data from one disk to another.

In addition to running the unmodified software of the operating system, for applications programs, and for utility operations, the computer may also run special adaptive software designed to enhance the operation of the attached voice output module. Both the unmodified and the adaptive software can affect the use of the voice output module for computer access by the blind operator. The effects of both kinds of software on the functioning of the voice output module are discussed briefly below in this section and more completely in the following section, "Software for Voice Output Modules and Microcomputer Interfaces."

Unmodified Host Computer Software

The unmodified host computer software can affect the operation of the attached voice output module either positively or negatively from the user's point of view. Or the effects can be neutral or even a combination of advantages and limitations. But in general four points about the software already running in the host computer are important.

First, many of the microcomputers developed as a personal office computer or a home computer run the CP/M operating system, which facilitates the use of voice output modules by directly sending ASCII code to the computer RS232C serial port for transmission. This feature faciliates the module's acceptance of the code to be converted to speech.

Second, an additional advantage of the CP/M operating system is that some 10,000 applications programs (many of which are in the public domain) are available to users and can be purchased very inexpensively. Many of these programs are appropriate for use with a voice output module without any modification. Criteria for appropriateness are discussed in the section "Software for Voice Output Modules and Microcomputer Interface."

Third, a caution should be noted when purchasing any software. Some of it is protected and will not copy. This also prevents it from being transmitted to a voice output module. A buyer should ascertain that the software does in fact work with the voice output module prior to purchase.

Fourth, the software in the host computer can enable the user to review text through the voice output module, and, again, this is explained in the section entitled "Software for Voice Output Modules and Micrococomputer Interface." An example of a feature of the host computer software that would facilitate review through voice output would be a "line editor." With this feature, the computer will repeat a line or several selected lines when the appropriate command is entered on the keyboard; when the computer thus regenerates these lines, then the voice output module can again speak them. The Echo II interfaced with an Apple computer affords a specific example. The Echo II user can rely on the text editing software running in the Apple to have desired lines repeated or the cursor position identified.

Adaptive Software for Voice Output Modules

Adaptive software has been developed to run in microcomputers attached to a voice output module to enhance its usefulness. Adaptive Software includes programs designed to improve pronunciation, to provide review features, or to provide for applications in a display format compatible with voice output.

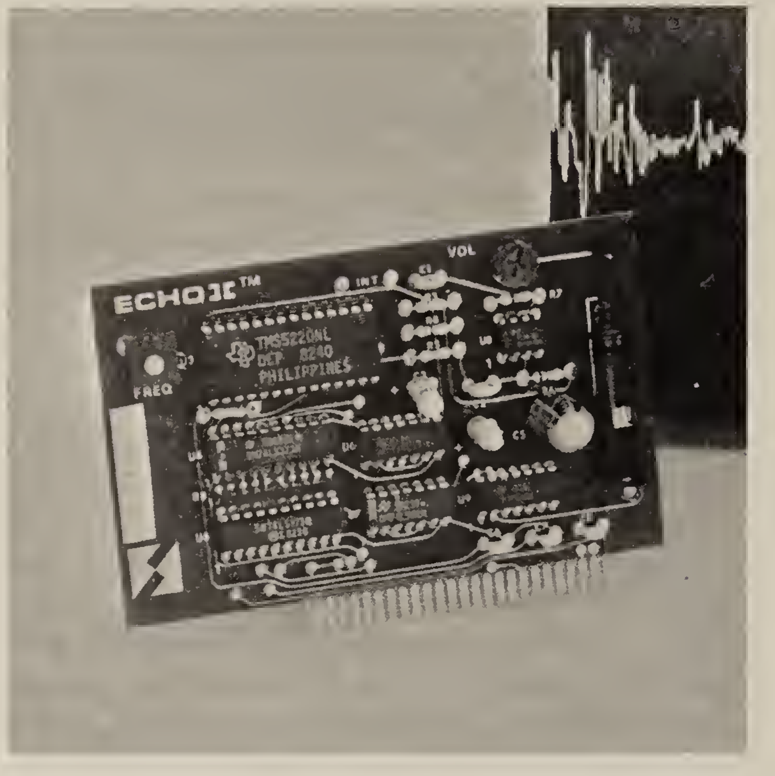
The pronunciation of the voice output module generally can be improved by adaptive software which runs in the host computer and changes the ASCII stream output as it is sent to the voice output module. This special software can "re-form the text into a 'phonetic' structure within the computer program before it is sent to the speech synthesizer. For example, the word 'computer' sounds far better if there are spaces on either side of the 'u'. In effect, the three separate components, 'comp u ter', are then translated to speech." ("Home Computing for the Visually Handicapped," Tom Vincent, p. 26) Likewise, software can be written to automatically expand abbreviations to their full word pronunciation (to have Mr. spoken Mister) or, as in the case of the Type 'N Talk mentioned above, to recognize symbols not ordinarily spoken and to form a code which will direct the module to announce them by name, and so on. The software described in the section "Software for Voice Output Modules and Microcomputer Interface" has been designed to enhance the voice output of these modules in some of these respects.

Since these devices operate in real time and do not provide any review features of their own, special adaptive software is also available to gain review features when for some reason the software of the host computer is inappropriate. This, too, is discussed further in "Software for Voice Output Modules and Microcomputer Interface."

For the ECHO II, the VOTRAX TYPE 'N TALK, and the VOTRAX PERSONAL SPEECH SYSTEM, adaptive software is available commercially. It may address one, two, or all three areas of concern, pronunciation, review features, or applications programs to work effectively with voice output. As described in the section "Software for Voice Output Modules and Microcomputer Interface," this commercially available adaptive software has been designed to run in the APPLE II+ or IIe and some models of the Radio Shack microcomputers which are connected to one of these voice output modules.

PRODUCTS COMMENTS, AND VENDORS

ECHO II



Echo II circuit board is pictured. The wire at right leads to the speaker, not pictured.

ECHO II consists of an electronic circuit board and a speaker to be used inside the APPLE II computer. The plug-in card is designed to convert text-to-speech and to audibly indicate the position of the cursor for review purposes.

ECHO II's audio cursor provides review features with the Apple running the text editing program: the audio cursor is directed by keyboard commands to specific line of the text to be spoken.

ECHO II, as do some other voice output modules, uses up a certain amount of the computer's memory to operate -- specifically 8K. However, another plug-in card can be added to expand memory.

The advantage of ECHO II is that it interfaces with the APPLE, which is readily available, easily maintained and repaired, and is in the low cost range.

Vendor: STREET ELECTRONICS
COMPUTER AIDS
FOLEY'S LOW VISION AIDS
SFB PRODUCTS

ECHO GP

The Echo GP rests on top of an Osborne microcomputer, for which it provides voice output.

ECHO GP speech synthesizer consists of a box housing hardware and software to convert a stream of ASCII characters to spoken words and letters. It is designed for use with all personal computers, excepting the APPLE II and the IBM PERSONAL COMPUTER.

ECHO GP can be interfaced with any host computer with an RS/232 port, a fairly standard computer feature.

ECHO GP does not have any screen review capabilities unless such capabilities are programmed into the host computer with which it is used. ECHO GP has been used with an Osborne with line editor software in the host system. Limited but reportedly adequate review capabilities for personal use have thus been achieved.

ECHO GP is considered to have only fair speech quality, with a raspy, mechanical sound and less intelligible consonants. Bear in mind that speech quality is judged to be of secondary importance, and pronunciation quirks are a problem only for novices.

ECHO GP is developed by Street Electronics. Considered by many consumers to be responsive to the special needs of visually impaired users, they route consumer inquiries to technical personnel to provide precise, clear infomation about use and potential.

Vendor: STREET ELECTRONICS

INTEX-TALKER

The Intex-Talker's front panel has an on/off indicator light (left) and manual volume control (right).

INTEX-TALKER consists of a box to be connected to a host computer for text to speech conversion. Keyboard commands entered on the host computer can direct the INTEX-TALKER to vocalize line-by-line, entire buffer, or letter by letter. The optional buffer expansion at an additional cost of $25.00 enables the user to download a program up to 2K bytes long (one computer screen) into the Intex-Talker buffer (temporary memory) from which it will be spoken as commanded.

INTEX-TALKER's expandable memory can also allow a program up to 8K bytes long to be stored in EPROM (semi-permanent, erasable read-only memory). With this feature the user can store a list of words with preferred pronunciations. (Example: Mr. Mister) This vocabulary will be checked before a string of ASCII characters is translated into speech; if a word is in the vocabulary, it will be replaced with its vocabulary definition. Extremely long user vocabulary tables may slow the operation of the Intex-Talker.

INTEX-TALKER is reported by the vendor to work with software developed by Ron Hutchinson of CompuTalkSystems.

Vendor: INTEX MICRO SYSTEMS

MICROVOX

MICROVOX consists of a box for text-to-speech conversion, MICROVOX reportedly has good speech. Text-to-speech conversion is performed independently of the host microcomputer, thus freeing the host computer to perform other tasks.

Adaptive software for review features or applications has not yet been developed for use with the MICROVOX specifically.

MICROVOX enables the user to hear data input a letter at a time, a line at a time, or the entire 1000-3000 character buffer.

MICROVOX can speak on a programmably delayed basis which allows user to hear the contents of the buffer after typing the input.

MICROVOX is also available as a complete kit at a savings of $80.00.

MICROVOX is fully documented, and for the technically versed user a full schematic, memory map and parts lists (in print) encourage custom programming and application.

Vendor: THE MICROMINT, INC.

VOTRAX TYPE 'N TALK

The Type 'N Talk has controls for volume and frequency (speech rate) on the front panel.

VOTRAX TYPE 'N TALK consists of a box for text to speech conversion from a host computer. Text-to-speech translations are performed independently of host. The user's computer is free to perform other tasks.

VOTRAX TYPE 'N TALK as well as the ECHO GP is considered to have superior speed in translating text to speech. There is little delay between the appearance of the text on the screen and the spoken output.

Users consider the voice quality good, but it can be adversely affected by changes in frequency.

Frequency is controlled by a knob on the front panel. The higher the frequency is raised, the more speech rate and pitch both increase. This can create a sqeaky speech comparable to playing a phonograph record at a higher than specified speed.

The Caps on Mode allows acronyms to be spelled rather than pronounced as words. It is set from the keyboard of the host computer and recognizes an acronym by whether or not it is capitalized. If only the first letter of a word is capitalized such as proper nouns, the word is translated by the text-to-speech rules. But when two or more letters are capitalized at the beginning of a word, the entire word is spelled out, letter by letter. This automatically separates acronyms, which are capitalized, from an English-text string. For example, the words "TIN" and "BOB" are pronounced "tee-eye-en" and "bee-owe-bee", but the words "Tin" and "Bob" are pronounced "tin" and "bob."

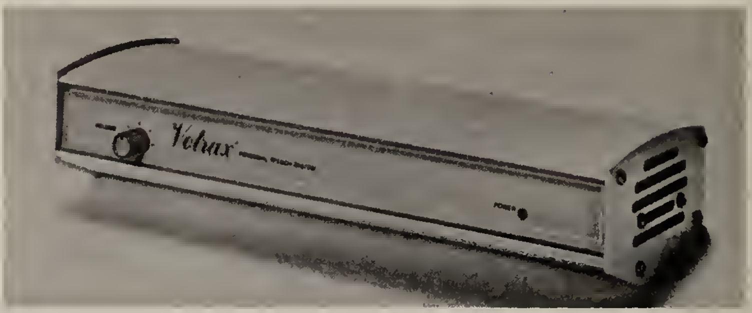
A list of over twenty programs developed to run in specific microcomputers interfaced with TYPE 'N TALK is available from VOTRAX. Programs include translation systems to provide English/Spanish bilingual output, and many educational programs for learning spelling, math, and spatial concepts through speech.

Adaptive programs to run in Radio Shack microcomputers and work with the Type 'N Talk to provide review features and/or other enhancements are available from CompuTalk-Systems (see details and cost in following section on software) and Professor Peter Maags of the University of Illinois at Urbana-Champaign (free upon request).

For the Type 'N Talk to announce punctuation, an adaptive program must be written and loaded into the host computer.

Vendors: VOTRAX
COMPUTALKSYSTEMS

VOTRAX PERSONAL SPEECH SYSTEM



The PSS has volume control and on/off indicator light on front panel while speech rate and pitch ontrols are on back (not shown).

VOTRAX PERSONAL SPEECH SYSTEM consists of a box for text to speech conversion. It has a larger buffer, 3500 characters, which can support versatility in review features when used in conjunction with adaptive software to run in the host computer and provide such review. See following section on software for commercially available adaptive software.

Desired speech rate, amplitude/fade control to provide special word/phrase emphasis, and inflection levels are all programmable, which means the user writes a program to be loaded into the host computer to have these voice parameters meet needs and preferences.

The user may also use the host microcomputer to set up a user definable exception table to augment existing translations for mispronunciations and abbreviations. Once set up on the host microcomputer, this table is sent to the Personal Speech System for storage and use in checking words and substituting pronunciations where so defined.

VOTRAX PERSONAL SPEECH SYSTEM is considered to have a pleasant sounding voice.

Vendors: VOTRAX
COMPUTALKSYSTEMS
MICROMINT INC.

Characteristic Chart

The characteristic charts have been prepared to help the reader compare similar devices to each other. In the Voice Output Module chart some characteristics listed elsewhere are not rated since none of the devices can provide these features.

Characteristics Chart

VOICE OUTPUT MODULES

- All except ECHO II require a cable for specific microcomputer (or terminal) to be connected to module; cables are available from vendors at additional cost and range $25-40.
- Additional speakers may be added, if desired.
- All have unlimited vocabulary and can vocalize text either as words or letter by letter.
- All can distringuish upper and lower case letters.
- All vocalize data as it is typed or displayed.
- All provide the following interface features:
  - choice of RS232C or parallel connection
  - serial X-ON/X-OFF handshaking to control buffer overflow
  - support of baud rates of 75-9600

VOICE OUTPUT MODULES	ECHO II	ECHO GP	INTEX-TALKER	MICROVOX	VOTRAX TYPE 'N TALK	VOTRAX PERSONAL SPEECH SYSTEM
Price	$149.95	$299.95	$295.00*	$299.00	$249.00	$395.00
BUFFER SIZE						
Lines/Screens	3 lines	6 lines	9 lines	12 lines	9 lines	1+ screen
Characters	256	512	750 (2.7K)	1000	750	3K
VOICE PARAMETERS						
Unlimited Vocabulary — Spell Full Word	Yes		Yes	Yes	Yes	Yes
Can Vocalize Punctuation/Symbols	Yes		Yes	Unknown	No	Yes
Automatically Spells Acronyms — Words in all Caps w/Central Vowel	No		No	No	Yes	Yes
Can Pronounce a String of Digits as Words e.g. 10 = ten	No		No	No	No	Yes
VOICE PARAMETERS						
Speech Rate — Control	2 Selectable Speeds Host Keyboard		Constant No	Constant No	Variable Manual Switch	
Volume — Control	Set on Internal Board	Variable Switch	Variable Switch	Variable Switch	Switch	
Pitch — Control	Selectable Host Keyboard		Selectable Host Keyboard	Unknown No	Rate Incr Pitch Incr	Selectable Switch
COMMERCIAL SOFTWARE AVAILABLE TO RUN IN HOST COMPUTER & PROVIDE FOR REVIEW FEATURES/APPLICATIONS WITH MODULE'S VOICE OUTPUT	Yes	Yes	No	Yes	Yes	Yes

*Additional buffer capacity (1+ screen) available at extra cost, $320.00 for units.

SOFTWARE FOR VOICE OUTPUT MODULES AND MICROCOMPUTER INTERFACE

Products

BRAILLE-EDIT
COMPU-TALK
SAY P/M
TALKING SOFTWARE/COMPUTER AIDS
TERMINAL PROGRAM/STREET ELECTRONICS

Classification: The above items are computer software to be run in the host microcomputer which has a voice output module added. The physical component of these items is a floppy disk on which instructions to the computer have been encoded, the disk resembling a small phonograph record. The instructions are called programs, and the software encoded on the disk can include one program or several. The floppy disk is inserted into the disk drive of the host computer, into which the program is then electronically loaded. This procedure is performed with each use of the computer.

In general, a computer program instructs the computer to perform a given function when the specified commands are entered on the keyboard. In the case of this specialized, adaptive software to work with voice output modules, programs are designed to instruct the microcomputer to activate specific capabilities of the voice output module and to perform certain review functions; some of this special software also includes certain applications of the computer such as word processing. For many users the most important capability contributed by the specialized software are the review features. Once loaded into the host computer, the software provides the ability to command both the current line on the screen and selected, previous lines to be vocalized any number of times for review.

Without this specialized software, the user may be able to hear the voice output module vocalize information one time only as it is being displayed on the screen, unless the unmodified software running in the host microcomputer can provide functions adequate for review with voice output.

Without specialized software, if screen review is desired after the first hearing, the user must regenerate the material on the screen by repeating the sequence of commands and procedures that originally created the text. If appropriate editing software is running in the host microcomputer, then the microcomputer can be commanded to review selected portions of the information on the computer screen. If the host computer can be instructed to read the fifth line above, for example, then that selected line would be voiced by the module. If the contents of the screen are conveniently regenerated, there is no problem in thus obtaining review. However, if this regeneration involves awkward or time-consuming commands and procedures, then the limitation of operating without specialized software is severely felt.

The specialized, adaptive software listed above and described in this section is designed to provide flexible review capabilities to the voice output user.

Software designed for these modules also provides for certain kinds of applications of the host computer such as setting up an address file, accessing a remote computer, or word processing. Designed specially for use with voice (rather than video) output, these application programs can include flexible review capabilities as well as a display format convenient for use with voice output. As is explained in the section on microcomputers with voice output, a line-oriented display format facilitates use of voice output for monitoring the functions of the computer and thus the user's interactions with it. A column oriented format, on the other hand, is an example of a display which can be difficult to use with voice output. To read a three-column spread, the sighted user might read down the first column, then the second, then the third. Or he might read across to compare headings and items entered beneath them; because of the position of the information on the screen, listed vertically under the appropriate heading, he always knows to what category individual items in the list refer. However, with voice output, cues for such orientation can be lost. The user hears lines of information read horizontally and can easily lose the initial reference points. Applications programs designed to be used with voice output avoid such format difficulties.

BRAILLE-EDIT

The software runs only in the APPLE and APPLE clones as the host computer; however, the voice output module can be any brand and model with a serial output connection and unlimited vocabulary. The developer recommends strongly the APPLE IIe, APPLE 2+, or a Franklin computer.

This software provides a word processing program with review features for voice output in addition to containing other programs on the disk such as a braille translation program. It can format text input to the microcomputer for output in print, video, voice, or braille.

The word processing program (similar to Documents software described below under Talking Software/Computer Aids) provides for the following functions: insertions, deletions, switching and rearranging paragraphs, merging text, centering, page numbering, underlining, page design, and a "global replace" feature. For speech review it supports the following commands: speak next 10 words but do not advance cursor; speak next l0 words and do advance cursor; voice entire text; and others. It does not have commands to back up and speak a specified block of words.

Some users have noted that the software provides several, sometimes complex options for formatting the text and that this menu structure can be difficult for some to learn.

BRAILLE-EDIT makes it possible to work with speech, braille, and screen display simultaneously. This is considered a breakthrough since it eliminates the communication barrier between blind and sighted co-workers.

A newsletter with updates in the software and information on developments in braille and speech output technology, user articles and information on interfacing other peripherals such as printers is provided by the developer.

Vendor: David Holladay
RAISED DOT COMPUTING

COMPU-TALK

COMPU-TALK is designed specifically for Radio Shack TRS-80 Models II, 12, and 16; and Models I and IV. The Lobo Max80 computer is also recommended. The developer points out that each system has its own special features, and both should be considered in light of current and future application expectations. A version to work with the TRS-80 Model III is soon to be marketed.

COMPU-TALK developer recommends the VOTRAX PERSONAL SPEECH SYSTEM because of the superior speed provided, but the software can also work with the INTEX-TALKER.

COMPU-TALK provides the following review features: voice can be turned on or off at any time; words are spoken or spelled according to choice; upper/lower case indicated; acronyms (groups of upper case letters like USA) are automatically spelled; cursor is audibly identified by line and column number; keystrokes can be echoed; special characters and punctuation can be announced; control keys can be identified; a page can be reviewed; the line on ·which the cursor rests can be spoken; specific lines can be selected for review. e COMPU-TALK works with most Radio Shack software for specific applications of the computer, including Bi-Sync and Scripsit 1.0.

MODEM80 is a software package available with COMPU-TALK to allow the host computer to act as an intelligent terminal for a remote computer.

Vendor: Ron Hutchinson/JC Cramer
COMPUTALKSYSTEMS

SAY P/M

SAY P/M is designed to run in a Heath-89 or Zenith-89 microcomputer with at least 48K of random access memory (RAM) and to drive a Votrax Type 'N Talk . The developer states that Say P/M can be run on other CP/M computers, but the user would have to alter the CP/M BIOS in that computer and interface the Speech Mode Box to it.

SAY P/M has specialized hardware requirements in addition to the microcomputer and voicè output module. It also requires a Speech Mode Box with appropriate connecting cable and a Custom Board; schematics for both are provided by the vendor. Or the vendor will build the Speech Mode Box, the Custom I/O Board, and the two cables at additional cost.

SAY P/M enhances the speech of the Type 'N Talk by improving pronunciation of certain problem words. Ongoing changes to the software are planned and continuing improvements will be made available to users.

SAY P/M contributes the following review features: selection of one of five speech modes, with the ability to change modes at any time -- No Speech, Letter Mode (with Upper/Lower Case Identification), Word Mode, Line Mode, and Phonetic Alphabet Mode (e.g., says Bravo for "b", Delta for "d", etc.); repetition of current line; announcement of current speech mode; announcement of control characters as they are typed (e.g., carriage return, tab, etc.).

SAY P/M software also includes a program called MODEM. Thus the addition of a telephone modem will allow communication with a remote computer in order to access or transfer files. The host microcomputer can act as a terminal.

Vendor: PSYCHO-LINGUISTIC RESEARCH
ASSOCIATES
VERNACULAR VOICES

TALKING SOFTWARE

TALKING SOFTWARE from COMPUTER AIDS runs only in an APPLE 2e or APPLE 2+ microcomputer that operates at least one disk drive and that is equipped with an ECHO II speech synthesizer.

This software provides the following applications:

Documents (TM) requires a 64K system and provides for page formating, insert, delete, merge, memory search features. Similar to Braille - Edit, it is also a word processing program.

Directories (TM) provides the ability to set up an electronic filing system for such information as addresses, notes, recipes, etc., and includes the ability to alphabetize information entered.

Agenda (TM) enables the user to enter schedules, appointments, etc., and get up to nine days advance notice of their approach. Features include time, date, set clock, full 365 days on file.

Tool Kit requires two disk drives and contains all three programs above on a single disk. With use of this software, the Took Kit disk would be loaded into the first disk drive for loading into the microcomputer while the second disk would be used for data storage.

All above software is command driven rather than menu driven, which means that the user learns keyboard commands and their functions for various applications. The reduction in time spent hearing a menu functions to be selected is said to eliminate wasted time and boredom.

Review features operable with this software include the ability to hear what word or letter lies under the cursor at all times and to select desired sections of text for repetition.

Talking Terminal Option includes terminal emulator software plus all hardware required to provide the APPLE and ECHO II with talking terminal capability. See Terminals with Modular Voice for further description.

Vendor: COMPUTER AIDS

TERMINAL PROGRAM

TERMINAL PROGRAM runs in an APPLE computer that has been interfaced with an ECHO II. It is communications software that enables the Apple to access a remote computer via over telephone lines. With the Echo II added as well, the Apple running the terminal program becomes a talking terminal. To connect via telephone, a modem would be needed.

Vendor: STREET ELECTRONICS

IN-LINE SPEECH ADAPTORS

Products

CYBERTALKER 2
SPELLEX 80
VERT 6000
KURZWEIL READING MACHINE

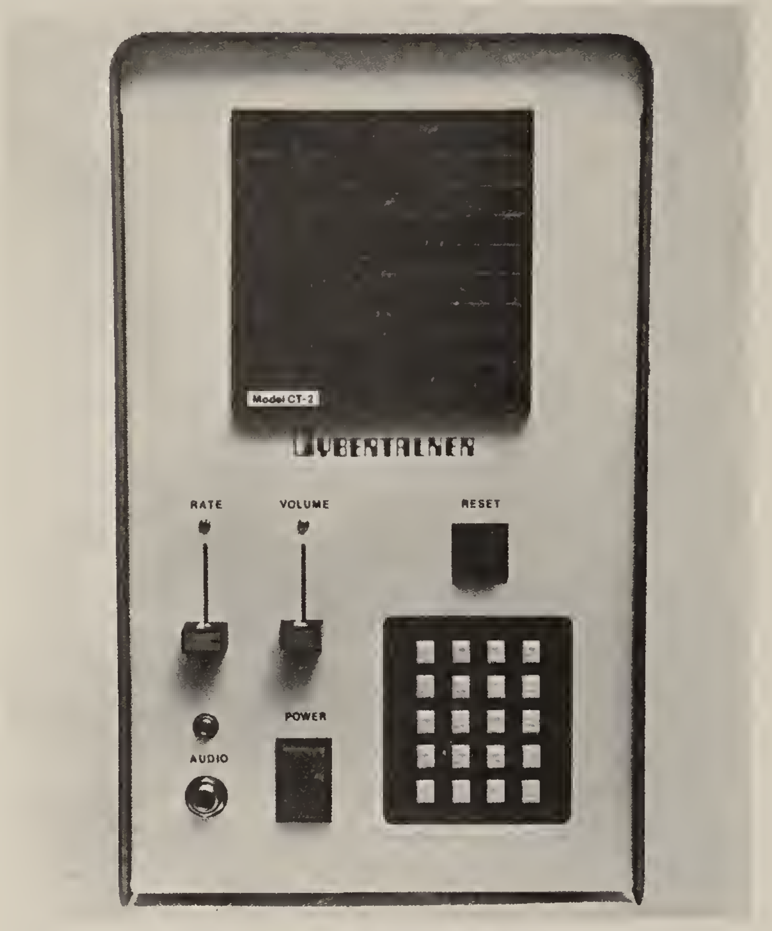
Classification: In-Line Speech Adaptors are peripherals with voice output capability designed to facilitate blind user interaction with computers. Like modules for voice output, In-Line Speech Adaptors are housed in separate boxes and must be connected to a host computer via a communications cable; none have independent data processing abilities. The devices possess large buffers, at least 2K bytes, which provide the capacity to hold in temporary memory at least one screen of data accessed from the host computer system. Unlike voice output modules, in-line speech adaptors also possess built-in software to provide review features allowing the user to command the adaptor directly to speak selected portions of the information held in the buffer. These review features can include the following functions: indication of cursor position; choice of full speech or spell-speech; line-by-line vocalization of text from selected line onward; pause in the reading of a file for review; reading of previous lines or sections; choice of having punctuation; choice of having upper case letters announced; and choice of speech rate, volume, and pitch, among other features discussed for individual units. These review features allow the user to explore information held in the buffer much as a sighted user can scan the contents of a computer screen. Depending on the individual device, the features are activated either by commands entered on the keyboard of the host computer terminal or by pushing appropriate buttons on the adaptor. Refer to chart following discussion in this section to ascertain specific review features possessed by individual adaptors.

The VERT 6000, Spellex 80, and the CYBERTALKER 2 have one communication line connection between the adaptor and the computer and a second communication line connection between the adaptor and the terminal. Thus placed in series in the com munication line between the terminal and the computer, the adaptor handles both input and output. It allows material input on the terminal keyboard and then stored in the adaptor's buffer to be heard and edited and sent to the computer. Similarly material accessed from the computer can be stored in the adaptor's buffer for review. These devices are designed to work with a computer which has a terminal as a separate (peripheral) unit connected via a communications cable. However, special software is available to allow the VERT to be used with microcomputers (which house the computer [c.p.u.], keyboard, and screen in a single unit), and a special card is available to allow the CYBERTALKER to be used with an APPLE microcomputer specifically.

The KURZWEIL READING MACHINE is connected to the communication line between the computer and the terminal and taps off only the output line from the computer. Thus the KRM accesses a copy of the data stream sent from the computer while the stream is sent in parallel to the terminal screen, and it thus has no capability for taking material stored in its review memory and sending it to the computer.

While the VERT 6000, the SPELLEX 80, and the CYBERTALKER 2 were designed specifically for computer access, the KURZWEIL is to be seen as a special case in the category of in-line speech adaptors. The principal use of the KURZWEIL is as a reading machine converting printed text to speech. It can also be interfaced with a computer terminal or microcomputer to convert ASCII code to voice output, but it would be used for such computer access only where it is already available to a user.

CYBERTALKER 2



The Cybertalker has push switches for power on/off and reset and slide switches for rate and volume. The 20-key pad enters commands for review functions. Note their brailled surfaces.

CYBERTALKER 2 is a self-contained peripheral, with both software and hardware for text to speech conversion of ASCII code and extensive review features described above and listed on the characteristics chart. It is attached to the host system by RS232 cable; has a built-in speaker and earphone jacks. The front panel contains a 20-key, brailled keypad for activation of review commands, a control knob for on/off, and slide switches for speech rate and volume. The user's hand moves between keypad of the adaptor and the keyboard of the host device to activate review features and to interact with computer.

Variable baud rate and other interface configurations can be set from the keypad; up to five interface configurations can be stored in the device's memory.

A tape recorder or transcription device may be connected to the CYBERTALKER so that the user may hear dictation from the same earphone as the voice output from the CYBERTALKER; sound from the transcription unit causes the CYBERTALKER voice to stop until the dictation ends; then with footswitch control the user may hear the material which has been typed into the CYBERTALKER.

Vendors: Eliot I. Friedman
CYBERON CORPORATION
BOSSERT SPECIALTIES

SPELLEX 80

SPELLEX 80 is a peripheral for text-to-speech conversion in the spell-speech mode only. When it is interfaced with a microcomputer, the Spellex review features allow the user to move the free-scan cursor back and forward one position; up or down one line; to the top of the buffer or to the bottom of the buffer. If the cursor direction button is held down, the cursor moves up (or down) lines until the button is released. These controls allow the user to explore the contents of the buffer for review.

The lack of full-word speech is considered by some users to constitute a serious limitation. However, it should be noted that for some applications it might be adequate, applications in which only very structured information is to be accessed such as parts numbers, flight numbers, or computer programs.

SPELLEX 80 is designed to connect also to an electronic memory typewriter and to vocalize contents of the memory for the typist's review before the text is typed. Insertions, deletions, and corrections may be made and vocalized by using the scanning controls described above.

Vendor: Dr. M. P. Beddoes
DEPT. ELECTRICAL ENGINEERING
UNIVERSITY OF BRITISH COLUMBIA

VERT 6000 and LEGAL TALK

The VERT stands to the right of the terminal for which it provides voice output. Knobs on front panel control volume, speech rate, and pitch. Operator employs keyboard of host terminal to enter commands for review functions.

VERT 6000 is a self-contained peripheral for text-to-speech conversion of ASCII code and for extensive review features described above and listed in characteristics chart: it is connected to a host computer via an RS232 cable; it has a built-in speaker and earphone jacks. Its front panel contains control knobs for on/off, and control of speech rate, pitch, and volume. Its extensive review commands are activated by entering on the keyboard of the host system. The user's hands remain on the keyboard of the host device for all interaction with the computer and for control of voice and review features.

Review features listed cover over 50 different functions, equivalent only to Maryland Computers ITS and TOTAL TALK. The marking function is unique: at any point in the text, markers may be placed so that the operator may return to them later. Also unique in this category is automatic phonetic expansion: VERT automatically spells in phonetic expansion on the third request, e.g., "b" "bravo", "d" "delta" when user requests repetition of word or letter three times.

Legal Talk is a special version of the VERT 6000 which is modified to provide voice output and complete interaction with a terminal accessing the WESTLAW (TM) Legal Research Data Base System. Legal Talk is approved by WESTLAW for use with their service, which is designed for the law professional. The subscriber to WESTLAW pays a monthly rate for access time and receives in addition an approved terminal -- Hazeltine, Radio Shack, or IBM brands. The Legal Talk version of the VERT 6000 is connected to provide voice output.

Vendors: AUTOMATED FUNCTIONS INC.
TELESENSORY SYSTEMS, INC.

KURZWEIL READING MACHINE

Initially designed as a reading machine for the blind to convert printed text to speech, the KRM now has four modes: 1) Reading Machine, 2) Speech Output System, 3) Text Output System, 4) Talking Calculator.

In Reading Machine mode, the KRM "recognizes" the printed characters on a page and converts them to speech. In Speech Output System mode, the KRM can be interfaced with a computer to provide voice output. Connected to a computer system via a RS232 cable through its communications port, the KRM accepts a string of ASCII characters from the computer and converts them to spoken letters or words, according to the user's choice.

To review, the user moves a hand from terminal keyboard to KRM keyboard to select review commands: spell speech, back up a line, go forward a line, speak or suppress punctuation. Computer material in the KRM memory can only be heard and reviewed. It cannot be edited and then sent back to the computer.

The post 1982 KURZWEIL utilizes the voice ouput circuit board developed by Telesensory Systems Incorporated. Consumers have noted the improved speech since the introduction of the new speech board.

KRM does not indicate the position of the computer's cursor. Interpreting the position of the cursor is somewhat tricky but can be done by leaving the cursor in its position, putting the KRM in Time Out mode, and having it re-read everything from the beginning of input or output.

KRM would probably not be purchased for use as a voice output device for computer access exclusively, because it is very expensive compared to the alternative equipment for this purpose. However, if the KRM is in use as a text reading machine, then it can also be applied for computer access. The two functions can take place sequentially.

Vendor: KURZWEIL COMPUTER PRODUCTS

SOFTWARE FOR IN-LINE SPEECH ADAPTORS AND MICROCOMPUTER INTERFACE

Products

Microvert
Apple Cyber Interface Card MODEL AC-l (Zero Card)

Microvert

Microvert Software - For most configurations, VERT 6000 is installed between the user's terminal and computer. However, when the video display screen, keyboard, and microprocessor are contained in the same unit, MICROVERT software can be used with VERT 6000 to provide access even to these computers.

Microvert is to be run in any host computer that runs the CP/M operating system and is connected to the VERT 6000 for voice output. This software enables VERT to provide voice output from these popular microcomputers: Altos, Hewlett Packard l25, North Star, Tele-Video, Apple Series, IBM Personal Computer, Osborne, Vector Graphic, DEC, NEC, Radio Shack, Xerox 820.

Microvert Software also contains the following programs: Text Editor, Word Processor, Modem Connect, Find Command, On Line Documentation.

Microvert allows the VERT 6000 user to run the multitude of applications programs that are available for the CP/M microcomputers.

Vendor: Automated Functions
Telesensory Systems, Inc.

Apple Cyber Interface Card Model AC-l (Zero Card)

The **"Zero Card"** is an interface card for the Apple 2+ and the Apple 2E computers. This card will automatically interface the CYBERTALKER speech adapters to these computers and solve many of the problems encountered trying to use speech with protected Apple software.

The **"Zero Card"** runs in I/O slot #4 and automatically routes data going to the screen or other I/O slots to the CYBERTALKER in a format compatible with its interface.

Vendors: Cyberon Corporation
Bossert Specialties

Characteristics Chart
IN-LINE SPEECH ADAPTORS

Purchase of the Spellex 80 and the Vert 6000 includes connecting cable: cable must be purchased separately for the Cybertalker 2 and the Kurzweil Reading Machine.

All devices have the ability to:
- — Vocalize data as it is typed or displayed
- — Repeat selectively previous words and lines
- — Skip/skim lines for review
- — Pause voice immediately at selected point
- — Distinguish upper/lower case letters
- — Vary volume according to manual control
- — Connect to RS232C serial port of host
- — Support selectable baud rates

IN-LINE SPEECH ADAPTORS	**CYBERTALKER 2**	**SPELLEX 80**	**VERT 6000**	**KURZWEIL READING MACHINE*** **
Price	$5000.00*	$3000.00**	$5995.00	$29,800.00
Buffer Size (Review Memory)	2 screens/4K	2 screens/4K	6+ screens/12K	1 screen/2K
Separate Keypad for Control of Review Features	Yes	Yes	No	Yes
REVIEW FEATURES Unlimited Vocabulary	Yes	No	Yes	Yes
Speaks full Words	Yes	No	Yes	Yes
Can Spell-Speak Words	Yes	Yes	Yes	Yes
Can Report Status-function on/off	Yes	No	Yes	Yes
Can Announce Commands/Functions w/out performing	Yes	No	Yes	Yes
Can Identify Cursor Position	Yes	Yes	Yes	No
Can Vocalize Corrections	Yes	Yes	Yes	No
Can Vocalize Punctuation and Symbols	Yes	No	Yes	Yes
Automatically Spells Acronyms	Yes	Yes	Yes	No
Automatically Pronounces Abbreviations as Words	Yes	No	No	Yes
Can Vocalize a string of digits as Words, e.g. 10 = ten	Yes	No	Yes	Yes
Can Pronounce Nonprintable Computer Characters	Yes	No	Yes	No
Automatically Suppresses Repeating Characters	Yes	No	Yes	No
Can Supply User-Defined Vocabulary	Yes	No	Yes	No
Can Expand Letters Phonetically	No	No	Yes	No
Can Identify Columns	No	No	Yes	No
Can Traverse Tables by Row & Column	No	No	Yes	No
Can Mark Text for Review	No	No	Yes	No
Can Search Buffer Review Memory for Specified Word/Character String	No	No	Yes	No
VOICE QUALITY PARAMETERS Speech Rate	30-250 wpm Manual Switch	Normal Constant	60-720 wpm Manual Switch	60-300 wpm Manual Switch
Pitch	Variable Manual Control	Constant	Variable Manual Control	Variable Manual Control

*With buffer expanded to 10+ screens or 20K, the cost is $6000.00.
**Canadian dollars
***All information given for the KRM may be accurate for operation in the SOS mode only.

TERMINALS WITH VOICE OUTPUT

Products

ARTS ORATOR II
IBM 3278 MODEL 2 DISPLAY UNIT
WITH AUDIO OUTPUT FEATURE
JUPITER AUDIO RESPONSE CONSOLE
MARYLAND COMPUTER SERVICES TOTAL TALK
TRIFORMATION SYSTEMS FREE SCAN SPEECH TERMINAL - 3

Classification: Terminals with Voice Output contain the hardware and software to perform the ordinary functions of terminals in retrieving data from and inputing to a host computer, including a remote mainframe, and they also employ a speech synthesizer and speaker for vocalizing the material retrieved from or input to the computer. They interact directly with the host computer. Information which is accessed from the host is stored temporarily in the local memory of the terminal where it is converted to synthesized speech if the voice capability is integrated into the terminal or it is sent to a voice output module which has been attached to it. During access, the number of screens held in memory depend on the number sent from the host computer; all terminals listed have at least 32K RAM (random access memory) to hold up to 16 screens. Display memories are all at least 2K or 1 screen; display memory determines the number of screens that can be held during input before being sent to host. The voice output capability of these computers enables the user to hear information as it is typed in, if desired.

Terminals with voice output include extensive, complete review features along with the ability to edit text before it is sent to the computer. These features may be either a capability of the terminal itself or of the remote computer which the terminal is accessing. The search feature, for instance, is a function of the remote computer and its software; if this system can search for and locate a given string of characters, then the talking terminal can provide that information in voice output. On the other hand, the editing capabilities of the talking terminals, which enable text to be changed before it is transmitted to the host computer, exist in the terminal itself. For the specifc brands, the extensive review features are detailed on the chart concluding the terminal section.

Note: many microcomputers, when loaded with appropriate software and interfaced with a telephone modem, attain the capabilities of an intelligent terminal providing for off-line preparation and review of files: refer to Micrcomputers with Voice Output and concluding chart.

Products, Comments, and Vendors

ARTS ORATOR II

The Orator II consists of terminal keyboard and voice output capability housed in box (left). The Large Print Video Display pictured is available at additional cost.

ARTS ORATOR II is a custom-made terminal which employs a VOTRAX SC01 Speech Chip. Users have noted the good quality of the speech. (ORATOR I model uses a VSB Speech Board; otherwise features are identical.)

Selection of line or section to be explored is made by keyboard command.

It does not have a video display screen, but does provide a choice of three keyboards: IBM typewriter format, extended keyboard, or telecommunications format.

For review features and functions, refer to chart.

Vendor: ARTS Computer Products

IBM 3278 MODEL 2 DISPLAY UNIT with AUDIO OUTPUT FEATURE

IBM's Talking Terminal produces synthesized speech from a standard IBM terminal, which contains a synthesizer similar to the one used in the IBM AUDIO TALKING UNIT (designed to provide voice output from a memory typewriter).

Keyboard and video display screen are integrated into the terminal unit.

Lines or sections for repetition is made through the use of a pointer (sometimes called a free scanning cursor by other manufacturers) which is moved to the desired position on the screen. The cursor stays in position of last data entered or received.

If any fields are highlighted, it can be indicated by depressing the appropriate key. Row and column number will be announced, after which the user may ask for the highlighted field to be read.

IMB computer equipment requires IBM terminals for access because interface parameters and telecommunications protocols are unique and distinct from computer equipment of other manufacturers. The IBM 3278 talking terminal is designed specifically to access an IBM host computer, including the remote mainframes often standard equipment in big business, industry, and universities.

Since it is new to the market, no user comments are yet available.

Vendor: IBM

JUPITER VOICE RESPONSE CONSOLE

The Jupiter Console employs the Votrax PSS with speaker vents turned toward operator.

Jupiter's Terminal is a DEC Keyboard Terminal connected by a communications cable to a voice output module; any brand and model of voice output may be selected, but the manufacturer recommends the VOTRAX PERSONAL SPEECH SYSTEM because of its voice quality which users consider to be very good. A microprocessor, integrated into the terminal unit, supports the speech formatting, the host connection, and controls the speech synthesizer.

Repetition of selected lines is accomplished through the software of the host system which is given a keyboard command to locate and repeat a given line. For example, to have repeated a line located five lines previous, the user might enter the command -5,5 by depressing those keys; after the fifth line previous is be repeated, the cursor would automatically be returned to the original position.

It is designed to access the Jupiter Time Sharing System or other computer systems such as those supplied by IBM, Wang, Lanier, DEC, Data General, etc.

Vendor: JUPITER TECHNOLOGY INC.

MARYLAND COMPUTER SERVICES TOTAL TALK

TOTAL TALK II is a Hewlett-Packard 125 without disk drive. It does not provide off-line preparation capabilities, but with the addition of a disk drive ($1000.00), it can store data accessed from the host computer.

Repetition of desired lines is accomplished by depressing the appropriate cursor key to it to the desired location, up, down, back, forwards. Review may also be accomplished by depressing keys to read present word, previous word, next word; the same may be requested for lines and characters.

Users have noted its ability to handle highly formatted data such as retrieving phone numbers from the data bank of directory assistance service. The cursor restore function enables the user to store position coordinates to which the cursor will automatically advance when commanded so that predetermined sections of information can be quickly located and heard. See chart for list of review features.

TOTAL TALK II has 8 function keys and three modes. Depending on which of the three modes has been set, function keys take on a different meaning. Potential confusion can be averted by routine use of a particular sequence of modes and functions in a particular application.

Vendor: MARYLAND COMPUTER SERVICES

TRIFORMATION SYSTEMS FREE SCAN SPEECH TERMINAL 3

FSST-3 is a Zenith Z-19 terminal with a VOTRAX board and specialized software to support speech and review functions.

Repetition of desired text can be accomplished by depressing keys to move the free scanning cursor (audio pointer) to the desired location -- up, down, left, right, home, previous word, present word and next word. See chart for other review features.

It has successfully been interfaced via telephone modem to IBM 370 mainframe.

Vendors: TRIFOMATION SYSTEMS
DUXBURY SYSTEMS

Characteristics Chart

TERMINALS WITH VOICE OUTPUT

All have integrated voice except Jupiter Console which employs a commercially available voice ouput module.

All models listed in this section have the following characteristics:

keyboard/keypad
an unlimited vocabulary
full word speech
spell speech

ability to:
- vocalize data as it is typed or displayed
- select previous words/lines for repeated vocalization
- pause, i.e. voice will instantly stop when directed to review
- vocalize deletions, insertions and corrections
- vocalize punctuations and symbols

VOICE QUALITY PARAMETERS:

Both volume and pitch are selectable on all models by a continuous switch.

TERMINALS WITH VOICE OUTPUT	**ARTS ORATOR II**	**IBM 3278**	**JUPITER AUDIO RESPONSE CONSOLE**	**MCS TOTAL TALK II**	**TRIFOR-MATION FSST-3**
Price	$4199.00	$6217.00	*	$5995.00	$4485.00
Video Display	No	Yes	No	Yes	Yes
REVIEW FEATURES					
Display Memory	1 screen	1 screen	**	5 screens	1 screen
Reports Status — Functions On/Off	No	Yes	Yes	Yes	Yes
Announces Commands/Functions	No	Yes	No	Yes	Yes
Identifies Cursor Position	Yes	Yes	No	Yes	Yes
Distinguishes Upper/Lower Case	Yes	Yes	Yes	Yes	No
Identifies Columns	Yes	Yes	No	Yes	No
Automatically Spells Consonant Strings	No	Yes	Yes	Yes	Yes
Expands Letters Phonetically	No	Yes	Yes	No	No
Marks Text for Review	No	No	Yes	Yes	Yes
Skips Lines for Review	No	Yes	Yes	Yes	Yes
Searches Memory for Specified Word/Character String	Yes	Yes	Yes	Yes	No
Says Series of Digits as Words	Yes	No	Yes	Yes	No
Says Abbreviations as Words	No	No	Yes	Yes	Yes
Supplies User Defined Vocabulary	No	No	Yes	Yes	Yes
Traverses Tables by Row & Column	No	Yes	No	Yes	No
Pronounces Nonprintable Computer Characters	No	No	Yes	No	No
Suppresses Repeating Characters	No	Yes	No	No	No
VOICE QUALITY PARAMETERS					
Speech Rate/wpm	45-750	160-300+	Variable	45-720	100-425
— Control	Command	Switch	Switch	Switch	Switch
TRANSMISSION PARAMETERS					
Interface	RS232C	SKLC	RS232C	RS232C	RS232C
Baud Rate	110-9600	DNA	300-1200	110-9600	110-9600
Communications Mode	Full/Half Duplex, Async		Full/Half Duplex, Async***	Full/Half Duplex, Async	Full/Half Duplex, Async
Parity	Select-able	DNA	****	Select-able	Select-able
Communication Parameters can be Set from Keyboard	Yes	DNA	Yes	Yes	Yes

*$2000-3500, depending on options/protocol

**depending upon protocol

***higher speed synchronization optional

****parity recognized from host is ignored, transmitted to host even

DNA = does not apply (the IBM terminal is designed specifically to interface with other IBM equipment, which has transmission variables peculiar to IBM)

MICROCOMPUTERS WITH VOICE OUTPUT

Products:

AEON MICROCOMPUTER SYSTEM
AVOS COMPUTER PACKAGE
COMPUTER AIDS TALKING APPLE
MARYLAND COMPUTER SERVICES' ITS
TALKTEX
TEXAS INSTRUMENTS TI 994A
TRIFORMATION SYSTEMsS VIPS
WILLOUGHBY ENTERPRISES TALKING COMPUTER

Classification: These systems combine data processing capability with voice output. The brand name systems, while possessing their original capabilities, have been modified by the addition of adaptive software and speech synthesizer for voice output. The various systems can be differentiated by (1) the capabilities and purposes of the brand name microcomputer as a data processing tool and (2) the voice output system and its review features. Although voice quality and price are other differentiating features, the selection of a computer system is usually governed by the application where the capabilities and applications software of the microcomputer and the flexibility of the review features would be more significant. Unless otherwise indicated, all systems contain a video display as well as voice output capability. Some may also operate as intelligent terminals with terminal emulator software and the addition of a telephone modem: see chart which concludes the section.

Special applications software designed to work with voice output has been developed by some microcomputer vendors and is described in the text below. In choosing commercial applications software to run in a microcomputer for use with voice output, a consideration is the original display format. If it is screen oriented such as a spread sheet format which works as a two-dimensional presentation, it will be difficult if not impossible to use with voice output which is linear. See section on software following voice output modules for a listing of some applications software designed for voice output.

Products, Comments and Vendors

AEON MICROCOMPUTER SYSTEM

Computer components available from AEON are pictured. Clockwise from top left are disk drive, printer, telephone modem (note two cups to hold speaker and ear piece of phone receiver), two consoles with video display screens integrated with keyboards, and, in the center, separate keyboard and video display.

The AEON system is based on one of the Digital Group Computers by AEON Electronics. The CPU, disk drives, and telephone modems, can be purchased in much the same way as stereo systems in single components or as a kit. The Operating System (Oasis) is a Z-80 8-bit processor with 64K of memory. The manufacturer states that the Oasis operating system provides the highest performance for the least expense. The speech synthesizer has been developed by AEON and resides in a box which rests on top of the disk drive and is connected to the computer; connections may be brailled for easier assembly by the blind user, according to the manufacturer.

Originally the AEON talking computer was designed for industrial control, to provide audible readings of equipment status, etc. However, the company has developed it further to meet the needs of one of their employees, a blind computer programmer.

For review it has the capability to spell-speak input and output in real time; in addition 500 words typical to programming in BASIC have been programmed into the synthesizer's vocabulary.

Selective repetition of lines and words is activated by commands to the system's innate line editor.

The manufacturer states plans for enhancing the system with full word speech in the future.

Vendor: DIGITAL GROUP COMPUTERS by AEON Inc.

AVOS COMPUTER PACKAGE

AVOS COMPUTER PACKAGE consists of an Osborne 1 double density computer with CP/M operating system and a STREET ELECTRONICS ECHO GP connected by cable (included). The system includes software developed to drive the ECHO GP.

The unmodified Osborne 1 is marketed as a portable computer, and it is housed in a carrying case; the AVOS retains this original housing.

Review features (see chart) include a free scanning cursor -- a pointer that can be controlled by the user to explore the contents of the memory through voice output. The entry cursor maintains its position while the pointer is in use for audio review, enabling the user to return directly to the original work location. Review by page, line, and in three-line blocks is possible.

The package includes applications software for word processing, an electronic filing system, a personal finance package for checkbook reconciliation, budgeting, tax information, and two games in addition to the Osborne-supplied MBASIC, CBASIC, WordStar, SuperCalc, CP/M and CP/M utilities, on the original diskettes.

Terminal Emulator software is available (dumb version, $30.00; smart version, $100.00). With it and the addition of a Modem for telephone hook-up, the AVOS can be used to access such public data bases as The Source -- airline schedules, mailgrams, wire services, shopping -- and the Dow Jones with up-to-the-minute financial information. With the smart version the user can access a file in the data base, save it on disk, and read it at leisure.

Vendor: AVOS

COMPUTER AIDS TALKING APPLE

The TALKING APPLE package includes an APPLE IIe PERSONAL COMPUTER containing the STREET ELECTRONICS ECHO II for voice output; the software package includes Directories (TM) Software (see description in section on Software for Voice Output Modules.

Two options are available:

1) Word Processing Option is the basic TALKING APPLE described above and on the chart, together with Documents Software, a Smith-Corona Printer, and interface with cable (at $995.00 additional); 2) the Talking Terminal Option ($595 additional) provides user with an intelligent terminal in addition to a microcomputer.

Review features are listed on characteristics chart following this section. The user can hear word or character directly under cursor at all times; commanding the system to speak word or character under the cursor does not cause cursor to move ahead to next position as it does in many other systems. Review features are a function of the audio cursor in the ECHO II: activated by a keyboard commands, the audio cursor is moved to lines/words selected for review, and the text there is vocalized.

The features of the applications software are designed for use without sight and are line-oriented rather than screen oriented. They are also command driven rather than menu driven, meaning that the user enters commands to activate functions directly rather than chooses a function by number from a list of possible functions. This feature can save time by eliminating the need from lengthy vocal repetitions; should the user become confused, a "help" command does list options and explanations. Daily use of commands contributes to retention of their meaning.

Vendor: COMPUTER AIDS

FOLEY TALKING APPLE - PERSONAL TALKING SYSTEM II

Also based on the APPLE IIe with two disk drives and an ECHO II speech synthesizer, the PERSONAL TALKING SYSTEM includes a ProWriter Printer and assorted software.

Review features identical to COMPUTER AIDS TALKING APPLE.

Applications software (electronic filing, BASIC teaching program, telephone numbers file, etc.) is not necessarily designed for the blind user as is the COMPUTER AIDS software described in entry above. The vendor states that any unprotected APPLE software or BASIC software can run in the TALKING APPLE but programs with screen oriented displays such as spread-sheet formats for business/budget calculations are difficult or impossible to use with voice output, which is linear rather than two-dimensional in presentation.

Vendor: FOLEY'S LOW VISION AIDS

MARYLAND COMPUTER SERVICES' INFORMATION THROUGH SPEECH - ITS

ITS console, keyboard (left foreground) are pictured with disk drive visible between console and printer (right background).

ITS is a HEWLETT-PACKARD 125 PERSONAL OFFICE COMPUTER with CP/M operating system with a VOTRAX VSB Synthesizer board integrated for voice output. Software and hardware modifications support voice output and review features. Models are differentiated by disk drive:

Model 5 Single Disk Drive, $7995.00
Model 10 Dual Disk Drive, $8995.00
Model 20 Single Disk Drive, $11195.00
Model 30 Winchester Hard Disk Drive, $11995.00

Provides multiple review features (see chart) equivalent in number and versatility only to the VERT 6000 in the In-Line Speech Adaptor category. For additional description, see TOTAL TALK II entry in Terminals section.

ITS has three (3) modes and eight (8) function keys. The keys are located at the top of the keyboard. Depending on which mode the system has been set for, the given key can perform on of three different functions. Despite the seeming complexity, patterns of use become habitual. A menu can be spoken for each mode/function being performed.

MARYLAND COMPUTERS has developed a variety of applications software for use with voice output. Among these are the following:

TALKING INFORMATION MANAGEMENT SYSTEM (TIM II) -- Included in the ITS, all models, TIM II is an electronic filing system which alphabetizes and stores entries and retrieves them on command. (No additional charge.)

AUTOMATIC FORM WRITER($500.00) -- designed to permit the blind operator to fill out standardized forms once they are programmed by a sighted operator. For example, a blind accountant could prepare a l040 income tax form. ITS prompts the operator with the topic "Social Security Number;" the operator queries the customer and types in the number. All information to fill the blanks of the form is thus entered into the computer. When this process is completed, the operator commands the computer to direct a printer to type the proper information in the proper locations on the form.

THE SPOKEN WORD ($750.00) -- a word processing program based on the HEWLETT-PACKARD WORD/125, has these features from the original software: Automatic Word Wrap (the user enters text without pressing carriage return at end of line; words move automatically to following line, enabling uninterrupted input; Deletion and Insertion can be accomplished by depressing function keys and typing appropriate changes in text; Search and Replace; Free Scan Cursor (frees cursor from program control) has been added. Especially designed for voice output, it enables cursor to scan document vocally and return to original work position; standard print formatting options.

BRAILLE PRODUCTION($1,000.00) -- enables braille user to input by means of attached, Cranmer Modified Perkins Brailler. Braille is translated to ASCII code which is then translated to ink print output. Can also be used to input via keyboard and output in braille.

All additional peripherals such as printer for the word processing software and the Cranmer Modified Perkins Brailler are available at additional cost.

ITS may be used as an intelligent terminal for downloading data/information accessed from a remote computer and going off line to review or revise material.

Vendor: MARYLAND COMPUTER SERVICES

TALKTEX

The Talktex employs a Commodore home computer interfaced with an Echo GP which is housed under the cassette tape player (bottom left). Commodore software is obtained on tape cassettes.

TALKTEX consists of a Commodore VIC-20 computer with 5K memory (expandable to 21K) connected to an Echo GP and software to drive the speech synthesizer. The system includes a telephone modem and software enabling it to access public data bases. To obtain video display as well as voice output, the system may be connected to a TV. Software and Echo GP are enclosed in a box fitted with the computer into in a carrying case.

The VIC-20 is marketed by Commodore as a home or inexpensive computer.

Review is obtained by moving the entry cursor to the line, word, or character to be vocalized.

Developer states that the purpose of the TALKTEX is to provide voice output from the many VIC-20 programs available (ten are included in the package) and from public data bases accessed via telephone (subscriptions are included).

Vendor: DUFFY ENGINEERING INC.

TEXAS INSTRUMENTS TI 994A

TI 994A consists of a TEXAS INSTRUMENT PERSONAL COMPUTER to which the TI solid state speech synthesizer can be added together with the Terminal Emulator II software, all of which may be purchased separately, analogous to stereo system components. The software contains the program for text-to-speech conversion in English and also supports access to public data bases.

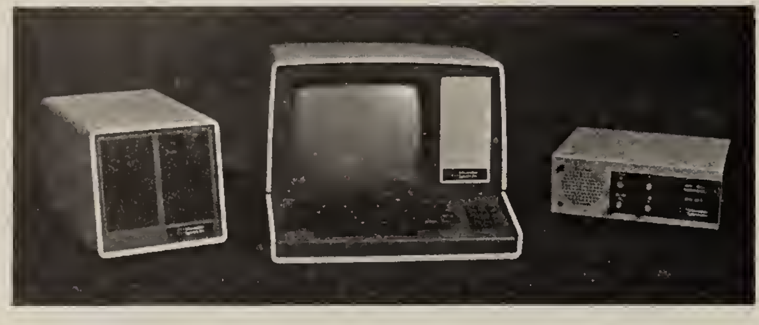
Review with voice output can be accomplished by entering a typed line and then recalling it. The computer can also be commanded to list all lines typed in, or it can be instructed to list only certain lines when they are indicated by number, for example, line 10 or line 23. Such review features are not considered flexible, yet for limited applications they may be adequate.

Only unprotected applications programs from TEXAS INSTRUMENTS may be used to obtain voice output.

The text-to-speech conversion uses a portion of the host memory and so may limit the use of applications software in addition.

Vendor: TEXAS INSTRUMENTS (available locally)

TRIFORMATION SYSTEMS' VOICE INFORMATION PROCESSING SYSTEM VIPS



The VIPS dual disk drive (left), microcomputer (center), and voice output module (right) combine to produce a talking computer system.

The voice output software and hardware (a TRIFORMATIONS AVC-2 speech synthesizer) has been added to a Z-90 data processor with CP/M operating system housed in microcomputer console.

Review features are listed on chart and described in the section on Terminals.

The CP/M operating system runs a huge variety of commercially available programs for applications.

Vendors: TRIFORMATION SYSTEMS
DUXBURY SYSTEMS

WILLOUGHBY ENTERPRISES TALKING COMPUTER

WILLOUGHBY ENTERPRISES TALKING COMPUTER is new to the market. The voice output (based on a VOTRAX TYPE 'N TALK) has been added to a microcomputer manufactured by Wycat Systems in Utah under license from Bell Laboratories where extensive systems software has been developed. The computer has an Unix operating system. For data storage it uses a Winchester hard disk.

WILLOUGHBY ENTERPRISES TALKING COMPUTER was customized for a blind librarian so that her entire card catalogue could be stored in the computer and accessed through speech. The developer chose this microcomputer because of its "power, depth, and richness" as a data processing tool. Its operating system contains 599 files to provide for very complex functions, and the user has available a huge storage capacity -- over 2 million characters. It has two command languages and supports two programming languages, C and Fortran; it has four editors and at least two text formatters, with the ability to interface with a phototypesetter in addition to the standard office printers. It has a preprocessor to generate tables, a program to generate calendars centuries into the future, and the ability to store, compute. and format complex mathematical formulas in addition to calculating numbers to unlimited degrees of precision.

WILLOUGHBY ENTERPRISES TALKING COMPUTER uses the VOTRAX TYPE 'N TALK because it was available readily when the initial development took place, because its vendor was wellknown, because the voice-rate is easily controlled by a knob on the front panel for changing pace in the middle of a sentence if needed, and because an Ambichron speech compressor could be attached to the Votrax Type 'N Talk to increase rate further without creating pitch increase problems.

WILLOUGHBY ENTERPRISES CRANMER TALKING COMPUTER can be:

- interfaced with a Modified Perkins Brailler for input.
- it can be set up for use by multiple operators.
- has software to direct the various speech parameters but no specific software for review purposes. The developer recommends the use of the available system editors for review purposes and editing and the search capabilities of the native system which are controlled by commands.

- Its system software includes proofreading capability: a dictionary of over 20,000 correctly spelled words and a dictionary of usage that can be run against a document that has been entered before it is printed out. The computer then speaks a list of possible errors to be checked by the author and corrected before printing. Since the voice output does not provide line numbers with the errors, the user would have to use the search capacities of the native system to locate the errors in the text for correction.

WILLOUGHBY ENTERPRISES TALKING COMPUTER is believed by the developer to have the advantage of capitalizing on the strengths of the native system since it is line oriented rather than screen oriented. He sees the system as interacting well with strong memory and interpretive skills. He further believes that this system could form the basis of further research into developing voice output into a tool to handle the highly formatted software which is the computer industry's trend.

Willoughby Enterprises Talking Computer can be customized by the developer for a particular application. Applications envisioned are pro fessional computer programming and high level data storage and retrieval tasks such as encountered in a television newsroom where wire service stories would pour in, needing to be stored and then searched and sorted to detect duplication; such as would be necessary for a telephone directory with more than 10,000 names; and such as a medical transcriber experiences in needing both a reliable word processor and a talking dictionary of medical terms.

Vendor: WILLOUGHBY ENTERPRISES

Characteristics Chart
MICROCOMPUTERS WITH VOICE OUTPUT

The characteristic "integrated voice" refers to microcomputers which have been adapted with internal hardware and software modifications to provide voice output. "Modular voice" refers to talking microcomputers which gain voice output capability by connection to a commercially available voice output module. We have included the Computer Aids Talking Apple in this class also. Although the Echo II circuit board which provides its voice output capability is connected internally, the board is available commercially as a component which may be obtained separately by a consumer and added to an Apple to create the same hardware package.

All of these devices reviewed here have ability to:

- — spell speak
- — vocalize data as it is typed or displayed
- — pause, i.e. voice will stop instantly when desired
- — vocalize insertions/deletions and corrections
- — selectively vocalize previous words and lines for review

All have the ability to:

- — set transmission parameters from keyboard
- — operate at full duplex or half duplex asynchronous
- — select parity

MICROCOMPUTERS WITH VOICE OUTPUT	AEON MICRO-COMPUTER SYSTEM	AVOS COMPUTER PACKAGE	COMPUTER AIDS TALKING APPLE
Price	$3800.00	under $3000.00	$2295.00
Integrated Voice	Yes	No	No
Modular Voice	No	Yes	Yes
Random Access Memory	64K**	64K	64K
Disk Drives	2	2	1
REVIEW FEATURES			
Unlimited Vocabulary	No	Yes	Yes
Full Word Speech	Limited	Yes	Yes
Can Report Status — Functions On	No	No	No
Can Announce Functions w/out Performing	No	No	No
Can Pause — Will Stop Voice Instantly when directed	Yes	Yes	Yes
Can Vocalize Punctuation/Symbols	Some	Yes	Yes
Can Pronounce Nonprintable Computer Characters	No	No	No
Can Distinguish Upper/Lower Case	No	Yes	Yes
Can Identify Columns	No	No	No
Can Traverse Tables by Row or Column	No	No	No
Automatically Spells Unusual Letter Combinations, e.g. KRM	Yes	Yes	Yes
Can Expand Letters Phonetically	No	No	No
Can Mark Text for Review	No	No	No
Can Skip/Skim Lines for Review	Yes	Yes	Yes
Can Search Memory for Specified Word/Character String	Yes	Yes	Yes
Can Say Numbers as Words	No	No	No
Can Say Abbreviations as Words	No	No	No
Can Supply Personalized Vocabulary	No	No	No
Can Suppress Repeating Characters	No	No	No
VOICE QUALITY PARAMETERS			
Speech Rate/wpm — Control	Constant	Normal/Compressed Keyboard	Normal/Compressed Keyboard
Volume — Control	Variable — Switch	Variable — Switch	Variable — Switch/Keyboard
Pitch — Control	Constant	Variable — Keyboard	Variable — Keyboard
TRANSMISSION PARAMETERS			
Interface	4 RS232C ports	RS232C Parallel	1 RS232C port
Baud Rate	300 to 19.2K	Selectable	Selectable
CAN OPERATE AS INTELLIGENT TERMINAL w/addition of appropriate software and Modem	Yes	Yes	Yes

*Expandable to 2 disks or hard disk at extra cost.

** Expandable to 128K at extra cost.

Maryland Computer's ITS	TALKTEX	Texas Instruments TI994A	Triformation Systems VIPS	Willoughby Talking Computer
$7995.00	under $2000.00	approx. $350.00	$7410.00	$12,700.00
Yes	No	No	No	No
No	Yes	Yes	Yes	Yes
64K	5K	16K	64K	512K
1*	Datacassette	Module Slot	2	Winchester Hard
Yes	Yes	Yes	Yes	Yes
Yes	Yes	Yes	Yes	Yes
Yes	No	No	Yes	No
Yes	No	No	Yes	No
Yes	No	No	Yes	Yes
Yes	Yes	Yes	Yes	Yes
No	No	No	No	THE WILLOUGHBY TALKING COMPUTER CAN BE CUSTOM-PROGRAMMED BY THE DEVELOPER TO PERFORM ANY DESIRED FUNCTION LISTED. SEE TEXT FOR COMMENTS ON VOICE QUALITY PARAMETERS.
Yes	No		No	
Yes	No	No	No	
Yes	No	No	No	
Yes	Yes	Yes	Yes	
No	No	No	No	
Yes	No	No	Yes	
Yes	No	No	Yes	
Yes	Yes	No	Yes	
Yes	No	Unknown	Yes	
Yes	No	Unknown	Yes	
Yes	No	No	Yes	
No	No	No	No	
45-720 — Switch	Normal/Compressed — Keyboard	Unknown	100-425 — Switch	
Variable — Switch	Variable — Keyboard/Switch	Unknown	Variable — Switch	
Variable — Switch	Variable — Keyboard/Switch	Unknown	Variable — Switch	
2 RS232C ports	Direct Connect Modem Included	Unknown	RS232C port	
110-9600	300	Unknown	100-9600	
Yes	No	No	Yes	

TIME SHARING SYSTEMS

Product: JUPITER Time Sharing System

Classification: A time-sharing system consists of a mainframe computer with several remote terminal devices using the input, processing and output facilities of the central processor of the mainframe. It is a method of allowing the mainframe to be used for two or more concurrent operations as the input, processing, and output of the various terminal devices appear to take place simultaneously. In fact, the central processor operates momentarily to carry out a finite series of steps for one device, then another, until the operations are completed.

The JUPITER Time Sharing System is specifically designed to include devices which provide computer access to visually impaired users as well as to sighted users. The multi-user computer system possesses visual display and voice output terminals, and braille, print, and large type output.

The JUPITER Time Sharing System would be installed at medium to large private or public agencies where a general purpose computer system equipped with visual, audio, and tactile input/output modes are desired. Agencies where a mixed population or staff of blind or sighted individuals work together would find this system to be an effective shared resource. Furthermore, remote access or satellite station connection to the JUPITER Time Sharing System would permit such agencies to support remote access over a wide geographic area where the delivery of services and training, on an economical basis, is desired.

Product, Comments, and Vendor

Components: Digital Equipment Corporation (DEC) PDP-11 processor, 256k bytes memory, dual floppy disk drives 1 megabyte, dual RL02 cartridge disk drives 20 megabytes, 8 to 16 communications ports, and optional letter quality and large type printers, optional braillers, and two or more user input stations either visual (CRT's) or voice output consoles. The system is supplied with all necessary cabinets and cabling for a turnkey system.

The system is also supplied with the JUPITER Time Sharing operating system, "Quick Braille" Grade II braille translator, word processing EDIT, type formatting program JUST, as well as a large number of utility programs including a complete programmers' workbench or operating system.

Function: To be used to input text or other file information to be translated into braille for braille production or output to large print printers for the partially sighted. General purpose programs may also be operated by blind users for word processing, schoolwork, business, and other professional activities.

Features: The JUPITER Time Sharing System provides a full range of on-line services such as word processing, file management, information retrieval, etc., comparable to medium size general purpose computer systems.

Technical Specifications: Standard Digital Equipment Corporation components with Facit/Dataroyal and Diablo printers. Supports standard asynchronous and synchronous interfaces to most vendor terminals and peripherals as well as attachment to other computer systems for networking purposes.

Price: $30,000 to $40,000 depending upon configuration

Vendor: JUPITER TECHNOLOGY INC.

EDUCATIONAL WORK STATION

Product: Open University Educational Work Station for Visually Impaired Students

Classification: A work station is defined by Robert M. Rinder **(A Practical Guide to Small Computers,** p. 58.) as "the input-output equipment which enables an operator to submit work to a computer and receive results." In the case of this educational work station for visually impaired students, input devices include a regular keyboard, a modified Perkins brailler, and a brailled overlay for the regular keyboard. The output devices include a printer (regular ink print), the modified Perkins brailler, a voice output module, and a large print video monitor. Available with the hardware is software for using the system with voice output for learning braille, word processing, and programming in BASIC.

Product, Comments, and Vendor

Components pictured are (top shelf, left to right) disk drive, speaker, large print video display, printer and (bottom shelf, left to right) brailler, keyboard topped by Type 'N Talk voice output module, and, finally, brailled overlay for keyboard.

Components: BBC microcomputer, disk drive, color or black/white monitor, dot matrix printer, Votrax Type 'N Talk voice output module, speaker and/or headphones, Star Microterminals Concept Keyboard, brailled overlays for keyboard, modified Perkins brailler, trolley, and software described below in "features."

Function: The objective of such a work station is to provide a wide range of facilities with the same hardware through software packages. The station can function as a talking typewriter, a braille transcription unit, a braille teaching unit, or an introduction to programming in BASIC, without any hardware changes. The video screen can enable a sighted teacher to monitor the progress of a pupil, or it can display enlarged characters for partially sighted pupils.

Currently, the work station has been placed in eight schools for the visually impaired.

Features: The software has the following features:

Introduction to braille: letters of the alphabet are spoken as they are brailled (Perkins Brailler) or touched (Concept Keyboard). Words or phrases (contractions or abbreviations) are spoken fully on completion. Other options include braille arithmetic to introduce the use of numbers, and musical braille as an interesting variation with embossed overlays.

Grade 2 braille test: the computer speaks words randomly selected from a vocabulary. The pupil responds either by brailling (Perkins Brailler) or touching (Concept Keyboard) the Grade 2 equivalent. There are no limitations on the vocabulary which is created by the teacher in advance with a simple utility program.

Talking BASIC: this provides all the programming features of BBC BASIC (except graphics) with a spoken output. This includes screen editing.

Talking Dictionary: a utility program to assist a teacher to obtain the most appropriate pronunciation for words and phrases. An alphabetical dictionary is maintained automatically, and can be viewed or printed.

Touch and Speak: this provides the teacher with a simple means of creating programs for speech output with individual overlays. Any pattern of responses can be achieved with the Concept Keyboard.

Talking Typewriter: in addition to spoken character responses during typing at the BBC microcomputer keyboard, word-processing features are included for text editing and file handling.

Price: Cost of the commercially available hardware components adds up to approximately L 2,500.

[The software is to be distributed through the Council for Educational Technology who hold the copyright.]

Developer: Dr. Thomas Vincent, Director*
Computing and the Blind Project
The Open University
North West Region
Chorlton House
70 Manchester Road
Chorlton-cum-Hardy
Manchester M21 1PQ
England

*The above product description was excerpted from "Computing and the Blind," a pamphlet on the system prepared by Dr. Vincent, and from a letter from Dr. Vincent to the editors of AAR.

Talking Products Enhancing Career Opportunities for Blind People

by

Michael Mason and John M. Williams

Talking products are marvels of our 20th century technology. On the market today there are many talking devices: calculators, adding machines, alarm clocks, typewriters, computer terminals, microcomputers, and a host of other products. To many people, talking products are more fictional than real, more futuristic than present. Talking computers remind them of Hollywood's evil, fictional robots come to life, with the most famous being Hal of Stanley Kubrick's "2001."

But talking products, especially talking computers or terminals, can inspire hope, confidence and the means to compete in a sighted world. And this is their meaning to Orville Martin, claims representative for the Social Security Administration (SSA) in St. Paul/Minneapolis, MN; Ben Mendelle, adjustor, Equibank, Pittsburgh, PA; and Belveia Benzenhafer, secretary, Metrolina Association for the Blind, Charlotte, NC. They see them as the compensater, perhaps the equalizer, which they need to do the same work as sighted people do. They see them as opening up advanced career opportunities for themselves and for other blind people.

"I have had my talking computer a very short time, but already it is a time saver. It eliminates many time barriers that have cropped up with people telling me I could not do my job because I am blind," says Martin.

"With my talking microcomputer, I shall be able to type and correct my own letters and even produce them in braille. This is a blessing to a blind secretary," stresses Benzenhafer.

"Technology is making a difference in the lives of blind people. In my life, I have used the Perkins Brailler, tape recorder, typewriter and now a talking terminal. Each of them has made a difference and has served a useful function. I believe technology will continue to improve career opportunities for blind people," says Mendelle.

Martin's Story

Martin is legally blind. Born prematurely, it was discovered that he had Retinitis Pigmentosa, an inherited degeneration of the retina. When he was 24 and attending St. Cloud State College, St. Cloud, MN, he lost his remaining vision to a combination of glaucoma and cataracts. Losing his eyesight was not a traumatic experience for him. He had been preparing himself for it all his life. Undeterred, he proceeded to complete his education and received a B.S. degree in Business. Shortly after he graduated, he started working with the SSA in January 1974 as a contact representative.

He answered questions about different aspects of Social Security over the telephone. The questions concerned SS benefits, Medicare requirements and disability requirements. He stayed at the position for 8 1/2 years. Finally, the opportunity came for him to be a claims representative.

"Being a claims representative is a more specialized field than a contact representative. There is more paperwork and a lot more details that I need to know. When the position came open, I decided I needed a sophisticated, talking computer to help me do the job, a computer that was faster and more accurate than braille output. What I knew I needed was a talking computer with good voice quality, one that could search for information quickly and quietly. It also had to have a good set of grammar rules associated with it."

Martin uses his talking computer at least four and not more than seven hours daily. His responsibilities include adjudicating SS claims. His workload has tripled since receiving his talking computer. He attributes this tripling to talking computer abilities in assisting him to become more independent, more productive and more efficient as he works on retirement, disability and survivors' claims.

There are a number of features that he likes about his talking computer. They are: unlimited vocabulary -- standard CP/M programs can be used without program modifications. His talking computer uses BASIC, COBOL, FORTRAN AND PASCAL languages. Its disk storage ranges from 250,000 to 8 million characters. It has user definable speech, intelligent terminal capabilities, two EIA standard RS-232-C interfaces and flexible disk drives of 5 1/4" and 8".

Two other assets he likes and utilizes are the applications programs. The file management program helps him access multiple items of information and store any alphanumeric information such as an account number, name, purchase number, grant number, job classification, etc. Using a form writing program. he quickly and efficiently fills out forms. It vocally informs him of each question on the form and then he types the answer. Martin comments, "I use my talking computer to help people who come here looking for information on Social Security benefits. The person sits next to me, and I ask for his or her name, employment status, length of years employed, number of years spent in the military and for other information. I put this information into the computer and then ask it to do a search on the person's file and then to read me the information once it finds it. The more I use it, the more I like it. My supervisor is trying to get me another one."

"Right now my talking computer solves all of my work problems. Its flexibility is a strong asset for me. My only wish is that it was portable. I would carry it with me all the time," says Martin.

Mendelle's Story

A resident of Pittsburgh, PA, Mendelle was born on June 24, 1947. Shortly after he was born, it was discovered he had cataracts. He could read large print until he was 11. At 11, he developed glaucoma and lost his vision totally. Fifteen years later, he graduated from Computer Systems Institute with an associate degree in Specialized Business (Computer Programming). In 1976, he graduated from Point Park College with a B. S. degree in Administrative Management, graduating cum laude.

Prior to working for Equibank, which employs more than 2,200 people in branch offices in and around Pittsburgh, he sold home care products, electronic telephone equipment and gave presentations on group insurance plans. He then started, and continues to do, public relations work for the Guide Dog Foundation for the Blind, located in Smith Town, Long Island, NY.

In August 1983, he was hired as an adjustor for the bank. His responsibilities include contacting people with delinquent credit card accounts. The majority of his contact with customers is by telephone.

Ben knew he needed a talking terminal to access computerized customer accounts, and after a demonstration, both he and the Office of the Blind and Visually Handicapped of the Commonwealth of Pennsylvania were impressed. The talking computer was purchased.

Benzenhafer's Story

Belveia Benzenhafer was born in November 1940 with Retinitis Pigmentosa. She attended the State School for the Blind in North Carolina, now the Governor Moorehead School for the Blind, from the first grade through high school, graduating in 1960.

Until her son Dana became a teenager, she stayed at home raising him and babysitting for other children. Sometimes she had as many as six. Finally, she decided it was time to continue her education. Her first adventure toward independence was getting a guide dog. Then she started at Piedmont Community College where she majored in Human Services, graduating in 1977.

Three years ago, she started working for the Metrolina Association for the Blind. As program secretary, she types reports, files and answers the telephone and performs other duties as they are required. The Association's filing system is set up in both large print and braille which makes it easier for her to work.

In March 1983, the Association acquired a talking computer for her to use. She received training on it and is now using it to help her do most of her work. She sees it as being efficient, time saving and believes it will reduce operating costs.

"Sometimes our clients need reports done in large and regular print and braille. In the past, this meant that the same report had to be typed three different times. The talking computer will do all of these jobs simultaneously," she says with a smile.

"The talking computer will also be very useful in helping me complete forms and in developing a directory which will give me immediate access to information. In the past when forms had to be completed either someone else did them or I did them and it was very time consuming because I had to stop frequently and ask for assistance. That was a problem. It is not now," emphasizes Benzenhafer.

Talking computers and terminals are revolutionizing the way people work in business, government, education, labor and other professional and non-professional areas. Businesses are finding more and more ways to utilize talking products to their advantage. And one of these ways is to employ either blind or visually impaired people. While talking computers may not solve all the problems in a work environment that they have for Martin, Mendelle, and Benzenhafer, they are making it possible for them and others to work in areas that would otherwise be closed to them. Talking computers and other talking products are both making history and changing it for the betterment of people everywhere.

Job Placements and Personal Applications with Voice Output Equipment

Below is a sampling of applications typical of equipment for computer access through voice output. Job titles or home uses and equipment are grouped under the categories used to structure the Resource Guide in this issue of AAR.

Voice Output Modules

Hobbyist to Access Radio Shack Model III using Votrax Voice Synthesizer (no longer manufactured, ancestor of Type 'N Talk and Personal Speech System)

Programmer for national mail order house/department store chain using Apple II with Echo II and Terminal Program to access IBM 303X system via telephone modem

University Mathematics Professor using an Apple with an Echo II to access remote main frame for the following applications: numerical computing, filing document preparation, lecture notes, letters, research papers

Students using Apple II+ or IIe with Echo II and Braille Edit Program to prepare homework, term papers, etc.

Law professionals using Apple II+ or IIe with Echo II and Braille Edit Program to prepare legal documents

Foreign Affairs Analyst in aerodynamics firm using Apple II+ or IIe with Echo II and Braille Edit Program to prepare position papers

Professor of Psychology using Apple II+ or IIe with Echo II and Braille Edit Program to prepare lecture notes, professional papers, etc.

Sales Representative for TSI using Apple II+ or IIe with Echo II and Braille Edit Program

Teacher at school for blind using Apple II+ or IIe with Echo II and Braille Edit Program to write doctoral thesis and to aid in teaching introduction to computer skills

Teachers and Law Professionals using Computer Aids Word Processing package to prepare documents -- package includes Computer Aids Software, Apple II+ or IIe and Echo II

Systems Analyst/Programmer using Osborne 1 with Echo GP for professional work at home

In-Line Speech Adaptors

Computer Programmer for business applications in major insurance company using VERT 6000 and local terminal to access remote IBM mainframe

Telephone Operator in large hospital using VERT 6000 with Data General Nova to to query data base for patient locations and status

Computer Programmer for scientific applications using VERT 6000 and DEC 10 and DEC 11 (Digital Equipment Corporation minicompu ters)

Secretary using a VERT 6000 with DEC 11 with UNIX operating system for word processing

Student using VERT 6000 with Apple running CPM to access Burroughs 5500 and CDC 6600

Lawyer using Legal Talk version of VERT 6000 with Apple to access Westlaw, CompuServ and other data bases

Law Professor at Temple University using Legal Talk version of VERT 6000 with Apple to access Westlaw

Corporate Lawyer at IBM using Legal Talk version of VERT 6000 with Apple to access Westlaw

Law Student at Columbia using Legal Talk version of VERT 6000 with Apple to access Westlaw

Computer Programmer with the Air Force using Cybertalker 2 and local terminal to access Burroughs and Honeywell mainframes

Students at University of Michigan using Cybertalker 2 and Local Terminal to access Amdahl mainframe.

Medical Transcriber using Cybertalker 2 to gain voice output from Olivetti Electronic Typewriter for word processing

Student of computer analysis at Glendale Community College, Arizona, using Cybertalker and local terminal to access DEC mainframe

Terminals with Voice Output

Student, Accounting Major/Computer Science Minor, using FSST-3 to access University's IBM mainframe via telephone, Novation (300 baud) modem.

Personal user of Orator I to access Radio Shack TRS-80 Model III for managing household accounts and files [Note: When Orator is used to access a microcomputer, two keyboards come into play, but the user may remain at the Orator keyboard to command both voice output and computer functions.]

Professor of Mathematics using an Orator II to access a Data General Nova for preparing class notes and writing a college text book

Computer Programmers using Orator II to access the following equipment: IBM Personal Computer; DEC, Honeywell, Data General, Amdahl mainframes.

Physician using Orator II with IBM Personal Computer to manage office and keep records

Answering Service Manager using Orator II with DEC 1123 minicomputer to log calls

Homemaker using Orator II with DEC Professional 350 to manage household accounts, file recipes, prepare personal letters, and assist children in homework

Bank Adjustor using Total Talk to access computerized customer accounts in remote mainframe.

Computer Programmer/Systems Analyst using Total Talk II to access UNIX and IBM mainframes

Computer Programmer using Total Talk II and a protocol converter (Computer Inc. Converter Box recommended by Maryland Computer Systems) to access an IBM mainframe

Word Processor in Oklahoma using Total Talk II to access an Amdahl V8 in Dallas, Texas, running the Script word processing program

Computer Programmer using Total Talk II to access a Univac 1182

Students at Community College of Denver using Total Talk II to access a DEC PDP 1134

Microcomputers with Voice Output

Manager for design group in space engineering company using the ITS (Maryland Computer Services's Information Thru Speech system) to manage files and prepare documents

Claims Representative for Social Security Administration using ITS with TIM II and AFW programs to store and retrieve account information and to fill out forms

Secretary for Rehabilitation Agency using ITS with the Spoken Word program to prepare document and have it printed simultaneously in regular print, large print, and braille

Counselor using ITS with TIM II to keep track of client files

Stockbroker using ITS with the Spoken Word and TIM II to manage correspondence and to store and retrieve client portfolios

Telephone Operator using ITS with TIM II to retrieve telephone numbers from storage in electronic file, at Yale University

Rehabilitation Counselor using AVOS to manage case files electronically stored and retrieved

Hobbyist using Texas Instruments TI 994A with voice output to write simple BASIC programs

Rehabilitation Counselor using Texas Instruments TI 994A with voice output to access Rehab-Net/SpecialNet, electronic mail box.

Hobbyist using Talktex for running Vic-20 spelling programs, and learning to program in BASIC, etc.

Librarian using the Willoughby System to store and retrieve card catalog.

TOOLS FOR FURTHER PRODUCT RESEARCH

Bibliography

Aveberry, L., R. Coverson, J. Humphries, and B. Meek. *Computers and the Year 2000* (Rochelle Park, N.J.: Hayden, 1973).

Ciarcia, S. "Build the Microvox Text-to-Speech Synthesizer. Part I: Hardware," *BYTE*, September 1982, p.64.

Dorf, R. C. *Computers and Man* (San Francisco: Boyd & Fraser, 1974).

Fons, K., and T. Gargagliano. "Articulate Automata: An Overview of Voice Synthesis," *BYTE,* February 1981, p. 164. (See also 'BYTE's Bugs: Upside-Down Static Phoneme," *BYTE,* May 1981, p.232.)

Foulke, E. "Microcomputers, VIPS, and the Communication Network, in *Braille Research Newsletter,* No. 13, June 1982. Edited by J. M. Gill, L. L. Clark, and E. Foulke, Research Unit f/t Blind, University of Warwick: Coventry, England, 1982.

Holladay, D. *Raised Dot Computing Newsletter, #1-6, 310 S. 7th Street, Lewisburg, PA 17837.*

Kimbrough, B. T. "Technology Update," in Dialogue, The Magazine for the Visually Impaired, Spring 1982, pp. 5-7.

Kimbrough, B. T. "Computerized Speech Unscrambled," in *Dialogue, The Magazine for the Visually Impaired,* Winter 1982, pp. 64-75.

Kimbrough, B. T., and P. Oto. "Computers (Part II)," in Close-Up Section of *Dialogue, The Magazine for the Visually Impaired,* Spring 1983, pp. 77-85.

Kimbrough, B. T., and P. Oto. "Computers (Part III)," in Close-Up Section of *Dialogue, The Magazine for the Visually Impaired,* Summer 1983, pp. 49-70.

Lauer, H. "Microcomputers for the Visually Impaired: Advice if You're Putting a System Together Right Now," in *Link and Go,* November 1982, pp. 1-3.

Lin, K-S., G. A. Frantz, and K. Goudie. "Software Rules Give Personal Computer Real Word Power," *Electronics,* February 10, 1981, p. 122.

Marbach, W. D., et al. "To Each His Own Computer," *Newsweek,* February 22, 1982, pp. 50-52.

Miastkowski, S. "Add a Voice to Your Computer: The Votrax Type-'N-Talk," *Popular Computering,* June 1982, p. 81.

Moran, T. P. (Guest Editor). "The Psychology of Human-Computer Interaction," in *ACM Computer Surveys,* Vol. 13, No. 1, March 1981.

Oto, P., and B. T. Kimbrough. "The Personal Computer: Is It for You?" in Close-Up Section of *Dialogue, The Magazine for the Visually Impaired,* Winter 1982, pp. 53-63.

Oto, P., and B. T. Kimbrough. "A Hard Look at Programming," in Careers Section of Dialogue, *The Magazine for the Visually Impaired,* Summer 1983, pp. 71-79.

Stoffel, D. "Talking Terminals," *Byte,* September 1982, pp. 218-227.

Veit, S. "Commodore Model Vic-20 Low-Cost Computer System," in Equipment Reviews Section of *Popular Electronics,* Vol. 20, October 1982, pp. 37-38.

Williams J. "Talking Computers Enhancing Careers of Blind People," in *Rehabilitation World,* Summer 1983, Vol. 7, No. 2, page 53.

Voice Output Devices for Computer Access
Vendors, Resources, and Prices

All products listed below provide voice output from a computer; products are identified according to categories used and explained in the Resource Guide in this issue of AAR: voice output module, speech adaptor, terminal, microcomputer, and software.

AEON Electronics
Suite MSB
1855 South Pearl
Denver, CO 80210
303-777-2366

Microcomputer: AEON Microcomputer System, $3800.00, page 36.

ARTS Computer Products, Inc.
~~80 Boylston Street~~ 145 Tremont St
~~Suite 1260~~
Boston, MA 02116 02116
617-482-8248

Terminal: Orator I, $4649.00
Terminal: Orator II, $3899.00, page 32.

Automated Functions, Inc.
4545 Connecticut Avenue, NW
Washington, D.C. 20008
202-362-6292

Speech Adaptor: Vert 6000, $5,995.00, page 29.
Speech Adaptor: Legal Talk, $6,995.00, page 29.
Software: Microvert, $495.00, page 30.

The above products are also available from:
Telesensory Systems, Inc.
Contact: Kay Ehlers
455 North Bernardo Avenue
P.O. Box 7455
Mountain View, CA 94943-5274
415-960-0920

AVOS 855 Third Street S.W.
New Brighton, MN 55112
612-633-4908

Microcomputer: AVOS Computer Package, under $3000.00, page 37.
Address for Main Office:
AVOS
Box 3857
St. Paul, MN 55165
612 - 633 - 4908

Dr. M. P. Beddoes
Dept. of Electrical Engineering
University of British Columbia
2075 Wesbrook Place
Vancouver, B.C. Canada V6T 1W5
604-228-3279

In-Line Speech Adaptor: Spellex 80, $3000.00 Canadian dollars, page 28.

Compu-Talk-Systems
Contact: Ronald C. Hutchinson (614-263-4324, after 6:30 pm only.)
Contact: J. C. Cramer (614-279-8271, after 6:30 pm only.)
Box 28355
Columbus, OH 43228-0355

Software: Compu-Talk, $129.95, page 25.
Cable: $49.95
Voice Output Module: Votrax Type 'N Talk, $249.95, page 21.
Voice Output Module: Votrax Personal Speech System, $399.95, page 22.
System Documentation Alone: $20.00.
Software: Modem 80, $49.95, page 25.

Costronic Electronics
Contact: T. Orr, Design Consultant
13 Pield Heath Ave.
Hillingdon, Middlesex
England

Voice Output Module: Microspeech, price unavailable.

Computer Aids
Contact: William L. Grimm
P.O. Box 5502
Fort Wayne, IN 46895
219-456-1856

Microcomputer: Talking Apple, $2295.00, page 37.
Word Processing Option, $995.00.
Talking Terminal Option, $595.00.
(Options contain necessary hardware and software for application with voice output).
Software: Documents, $150.00, page 26.
Software: Directories, $75.00, page 26.
Software: Agenda (Requires Thunderclock Peripheral Card, $75.00.
Software: Tool Kit (Requires two disk drives --all programs above on a single disk), $295.00, page 26.

Carl Foley
Foley's Low Vision Aids
1357 East David Road
Kettering, OH 45429
Microcomputer: Personal Talking System (Talking Apple), $3200.00, page 38.
Voice Output Module: Street Electronics Echo GP, page 20.
Voice Output Module: Street Electronics Echo II, page 20.

Cyberon Corporation
Contact: Eliot I. Friedman
1175 Wendy Road
Ann Arbor, MI 48103
313-994-0326

Speech Adaptor: Cybertalker 2, 4K $5000.00; 20K, $6000.00
Software: Zero Card, $270.00, page 28.

The above products are also available from:
Bossert Specialties Co.
P.O. Box 15441
Phoenix, AZ 85060
602 956 6637

Duffy Engineering Company
RFD #1, Box 387A
Nashawena Road
Mashpee, MA 02649
617-477-3834

Microcomputer: Taltex, under $2000.00, page 39.

IBM
Department 805
1133 Westchester Avenue
White Plains, NY 10604

Terminal: IBM 3278 Model 2 Display Unit with Audio Output Feature, $6217.00, page 33.
Word Processing Equipment: IBM Audio Typing Unit, $5200.00 connects to Memory 100 Typewriter, $3500.00.

The above products are also available in the United Kingdom:

IBM United Kingdom Ltd
389 Chiswick High Road
London W4 4AL
Tel: 01-995 1441

Terminal: L2231.00

Also from:
IMB
PO Box 41 North Harbor
Baltic House
Portsmouth PO6 3AU

Intex Microsystems Corporation
725 South Adams
Suite L8
Birmingham MI 48011
313-540-7601

Voice Output Module: Intex-Talker, $295.00, page 21.

Jupiter Technology Inc.
111 Gibbs Street
Newton Centre, MA 02159
617-965-5092

Terminal: Jupiter Voice Response Console, $2000.00 to $3500.00 depending upon options and protocol, page 33.
Time Sharing System: Jupiter Time Sharing System, $30,000.00 to $40,000.00 depending upon configuration, page 42.

Kurzweil Computer Products
185 Albany Street
Cambridge, MA 02139
Speech Adaptor: Kurzweil Reading Machine, $29,800.00, page 29.

Maryland Computer Services Inc.
2010 Rock Spring Road
Forest Hill, MD 21050
301-879-3366

Microcomputer: ITS with TIM II, Model 5, single disk drive, 3 1/2 " disk or 5 1/4" disk, $7995.00; Model 20, single disk drive, 8" disk, $11,195.00; Model 30, Winchester hard disk drive, $11,995.00, page 38.
Terminal: Total Talk II, $5995.00, page 34.

Micromint, Inc.
561 Willow Avenue
Cedarhurst, NY 11516

Voice Output Module: Microvox, $299.00, page 21.

Open University
70 Manchester Road
Chorlton-Cum-Hardy
Manchester M21 1PQ
England

Educational Work Station for Visually Impaired Students. page 45.

Psycho-Linguistic Research Associates
Contact: Vernacular Voices
P.O. Box 891
Menlo Park, CA 94025
415-854-1771

Software: Say P/M, $350, page 25.
Hardware: Speech Mode Box assmb/tsted, $300.00, page 25.

Raised Dot Computing
Contact: David Holladay
310 South 7th Street
Lewisburg, PA 17837
(717) 523-6739

Software: Braille-Edit, $300.00, page 25.
Resource Information: Newsletter, published monthly, print, $12.00;
audio cassette, $24.00.

Street Electronics
1140 Mark Avenue
Carpinteria, CA 93103
805-684-4593

Voice Output Module: Echo GP, $299.95, page 20.
Voice Output Module: Echo II, $149.95, page 20.
Software: Terminal Program, $40.00, page 26.

The above products are also available from the vendor below:

Science for the Blind Products
Box A
Southeastern, PA 19399

Texas Instruments
Box 10508
M/S 5828
Lubbock, TX 79408
806-741-4800

Microcomputer: TI 994A with solid state speech synthesizer and Terminal Emulator II software, around $350.00.

Triformation Systems
3132 S.E. Jay Street
Stuart, FL 33494
305-283-4817

Terminal: FSST-3, $4495.00, page 34.

Microcomputer: VIPS, $7410.00, page 40.

The above products are also available from:

Duxbury Systems
77 Great Road
Acton, MA 01720
617-263-7761

Erlybridge Communications
3rd Floor
2-4 Old St.
London EC1V 9AA
Tel: 01-215 4452

Votrax
Division Federal Screw Works
500 Stephenson Highway
Troy, MI 48083-7595
313-588-2050

Voice Output Module: Type 'N Talk, $249.00, page 21.

Voice Output Module: Personal Speech System, $395.00, page 21.

Willoughby Enterprises
Contact: Curtis Willoughby
2711 54th Street
Des Moines, IA 50360
515-277-8478

Microcomputer/Software: Willoughby Enterprises Talking Computer, $12,700.00, page 40.

Vendors, Products, Prices

Speech Output Products Designed for an Industrial /Entertainment Market*
The Alien Group
27 West 23rd Street
New York, NY 10010

Speech Synthesizer: Voice Box, model for Apple, $215.00; model for Atari, $169.00.

Speech Plus Inc.
461 North Bernardo Avenue
Mountain View, CA 94043
415-964-7023

Speech Synthesizer: Prose 2000 Speech Board, $4800.00.

*The above products may have potential for producing voice output from computers for use by the blind. But at this point no software support has been developed for these particular synthesizers. It should be noted that the Prose 2000 produces the high quality voice in the Kurzweil Reading Machine.

Glossary

This glossary defines terms of "computerese" used throughout this issue of AAR. It is by no means a complete list of the jargon one can encounter when talking or reading about computers. It is merely designed to serve as a rudimentary foundation in a vocabularly that will be built over time, if time is to be spent researching computer equipment for use or purchase.

Based most heavily on the excellent Penguin Dictionary of Microprocessors, definitions are occasionally expanded to include mention of the special case of equipment for voice output. And while most definitions have originated in the Penguin Dictionary of Microprocessors, some come from the glossary provided by Technology and Techniques for Expanding Employment published by the Sensory Aids Foundation.

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access To obtain data stored in a computer system.

acoustic coupler A device capable of transmitting and receiving audio tones which can be sent on telephone lines, allowing a modem to be linked to a telephone handset. Equipment used in accessing a remote computer via a telephone connection.

application The specific problem to the solution of which data processing techniques are applied. A distinction is often made between applications which are "computational", i.e., requiring considerable computing capacity, and those which are "data processing", i.e., requiring considerable data handling capacity. Typical applications include storing the card catalogue of a library on computer, inputing text into a computer to be edited and formatted for printout (word processing).

applications software Programs and packages designed to satisfy applications. Contrasted with systems software.

ASCII Acronym for American Standard Code for Information Interchange. This code, widely used by microcomputers for the transmission of data between a central processing unit and its I/O peripherals, consists of 128 letters, numbers, punctuation marks, and special symbols each of which consists of a binary pattern that uses seven binary digits. The remaining, called a parity bit, is used to detect certain errors.

asynchronous When the data signals between two or more units of equipment are not timed by the frequency of a common clock, they are said to be asynchronous. When such an asynchronous state exists, it is handled by a process known as handshaking.

BASIC Acronym for Beginner's All-purpose Symbolic Instruction Code -- a high- level programming language that is particularly popular among users of microcomputers because of its relative simplicity for programming.

baud A unit used in measuring the speed of transmission in a telephone or telegraph channel. In product literature for speech adapters, various baud rates are given for the speed at which the device can accept data from and send data to other components of a computer system.

binary A number system that has 2 as its base, and that uses only the digits 0 and 1. The binary numbering system is used by digital computers to perform the various tasks that are involved in data processing.

bit A contraction of binary digit. One of the two characters (0 and 1) used in binary notation. Also signifies the smallest unit of data, and is often used to mean the physical representation of a binary digit, e.g., as a magnetized spot on a recording surface or a pulse in an electronic circuit.

buffer Capable of accepting data and retaining it so that it can be retrieved and used when required, this store is designed to compensate for the different data rate between a transmitting device and a receiving device. In the case of speech adapators, the buffer is an important feature because it retains data accessed from the host computer until it can be spoken for access without sight. The size is given in terms of numbers of computer characters or computer screens which the buffer can retain at one time.

bus A conductor used for transmitting signals from one or more sources to one or more destinations. A bus transports data from one location to another within a computer. The kind of bus used by a given computer may determine how well a speech adapter can interface with it.

byte Eight bits. Most microcomputers use data words of eight bits, so in microprocessing, byte is generally synonymous with "word."

cathode ray tube (CRT) An electronic vacuum tube, such as a television picture tube, that can be used to display graphic images. CRT terminals are popular I/O devices for microcomputers. Also called video display unit or terminal screen.

central processing unit (CPU) A unit of a computer that handles the decoding and execution of instructions, controls the use of memory, performs arithmetic functions, etc. The CPU, which usually consists of an arithmetic/logic unit (ALU), several temporary registers, and control circuitry, is the heart of a computer system.

character Anything that is used to represent, organize, and transmit data; it may be a letter of the alphabet, a digit, a punctuation mark, or any special symbol (such as the plus sign or equal sign).

computer system The hardware of a central processor and associated peripheral units, including systems software.

cursor A screen character in a terminal display which indicates the location of the next character to be generated. The cursor can be moved to different positions on the screen by moving a cursor key. In word processing, for example, once a page has been input and appears on the screen, the cursor can be moved from the end of the last word typed to any other point in the text where an insertion, deletion, or correction might be required. With speech output, knowing the location of this cursor in relation to the text can be problematic.

cursor key A keyboard key used for manipulating the position on a terminal screen of a cursor.

data Any group of operands or factors made up of numbers, alphabetic characters or symbols denoting any condition, value or state. Data is often distinguished from information (which is what is conveyed by data) and from programs (program instructions operate on data).

data bank A large file of data available to many users, usually by means of remote terminals. The implication of data bank is that widely diverse uses are made of the data and that to some extent it is available to the general public. Contrasted with data base.

data base A file of data structured to allow a number of applications to access the data and update it without dictating or constraining the overall file design or content.

data processing The performance of a systematic sequence of operations -- mathematical, logical, or both -- on data by a computer.

data retrieval The bringing of data from storage to a location where it can be used or processed.

dedicated A program, procedure, computer or computer system set apart for special use. Word processors may be dedicated computers, for example.

disk A plate resembling a phonograph record and coated with magnetic material on which data may be "recorded" in great quantities for subsequent retrieval. "Floppy" disks are flexible and somewhat less costly to use; they are also called diskettes.

disk drive A disk drive is a recording device, something like a tape recorder but much faster. It automatically stores and recalls files on thin recording media called diskettes, synonymous with floppy disks. Disk drives can be built into the microcomputer unit, or they can be freestanding and connected by a cable.

dumb terminal A terminal device which can receive and/or transmit signals and therefore act as an input and/or output device but which has no local processing capability. The dumbness refers to lack of intelligence rather than any inability to produce voice output.

duplex A method of communication between two terminals in which each can transmit to the other simultaneously.

edit To change portions of a computer program or data by making insertions, deletions, or corrections.

editor A program or a portion of a program designed for a specific computer to be used for editing. The industry trend is toward full screen editors, but the original line-oriented editors are easier to work with using voice output.

emulator A hardware (and sometimes software) device built into a computer of one type but used to run jobs originally written for a computer of another type. The emulator thus accepts existing programs and data without requiring them to be rewritten for the new computer.

file An organized collection of related records. The records on a file may be related by a specific purpose, format, or data source, and the records may or may not be arranged in sequence. A file may be made up of records, fields, words, bytes, characters or bits.

format The specified arrangement of data, e.g., the layout of a printed document, the arrangement of the parts of a computer instruction, the arrangement of data in a record.

FORTRAN A high-level language, problem orientated for scientific and mathematical use, written in combination of algebraic formulae and English statements in a readable form. The name is an acronym for FORmula TRANslation.

full duplex Synonymous with duplex.

half-duplex A method of communication between two points in which signals may be transmitted and received but in only one direction at a time. Transmission specifications for speech adapters often include this term. Older, large mainframe systems may use this method of communication.

hardware The physical units making up a computer system -- the apparatus as opposed to the programs.

high-level language A computer programming language that is easier and more convenient for the programmer, because it allows the user to write instructions in a notation (problem-orientated or procedure-orientated) with which they are familiar, rather than in a machine code.

host computer The controlling machine in a multiple computer activity. In this issue the term is used to designate the computer to which a voice output device is attached.

input To transfer data or instructions from a peripheral unit into memory. Data or instructions which are so transferred. The signals applied to circuits to effect such a transfer.

input/output (i/o) device A medium or device with the function of inserting data or instructions into a computer and, after processing, transferring such data either to backing store, or to another computer system, or to a form suitable for human beings to understand such as the terminal's visual display, a paper print-out, or a voice output device.

intelligent terminal A terminal which can not only act as a remote input/output station but can also be programmed and provide a local processing capability without having to call on the processing power of the computer to which it is a terminal.

interface A common boundary between systems or devices, represented by the channels and associated control circuits making up the connections between a central processor and peripheral units, or between any two units.

internal memory A computer's main, high-speed memory, that is contained within the computer, as opposed to peripheral bulk storage.

i/o Abbreviation for input/output.

i/o port A port designed for use in conjunction with an i/o device.

keyboard A device for generating a character by the depression of one of a panel of keys. Similar to a typewriter keyboard.

keypad A hand-sized keyboard, may include cursor keys or other function keys; may be positioned beside regular keyboard or detached.

mainframe Now refers to large computers, distinguishing them from microcomputers, microprocessors and minicomputers.

menu The options listed by a display for selection by the operator, who selects the next action by means of an input device such as a keypad or keyboard.

microcomputer A small computer whose CPU is an integrated circuit embedded in a semiconductor chip. Integrated circuit technology has made it possible to develop small computers with enormous capabilities.

minicomputer A computer that is larger than a microcomputer but smaller than a big computer (mainframe). Whether a computer is a mini or a micro depends somewhat on price and memory size. There are, however, no clear-cut distinctions between the two categories.

modem Acronym for modulator/demodulator, a device that converts data so that it can be transmitted over communications (e.g., telephone) lines, and reconverts the data at the receiving end.

operating system The basic software or firmware which supervises and controls the running of other (user-oriented or application) programs; the operating system allows the system to operate the user programs, controlling the input and output functions.

output Information and data transferred from memory to devices such as printers or terminal screens or voice output devices.

page A block of fixed length, or a fixed number of blocks, which can be located as one entity in storage. Also data arranged to form a screen on a terminal.

peripheral Any device capable of being operated under control of a central processor such as a terminal or a printer or a speech adapter.

port An entry or exit from a computer dedicated to a single data channel. The place of connection for the cable to a printer or speech adapter, it is characterized by a certain configuration of connecting pins or holes to accept a certain arrangement of pins. An RS232 port is a standard port for connecting a peripheral.

printer Any one of several peripherals delivering hard-copy print-outs of computerized data.

program For computers, a program is a set of sequential instructions designed to achieve a specific result, and which a computer is capable of accepting.

protocol A set of conventions governing the format of messages to be exchanged between one process and another communicating with it. For example, central processors which need to communicate may operate at different speeds, on different word lengths, with different access controls, etc., and protocols need to be established so that each can recognize and act on signals being transmitted between them.

random-access memory (RAM) A computer memory that has been arranged into cells, any one of which can be "accessed" directly, rather than having to go through cells sequentially to reach the one that is desired. In a microcomputer, RAM refers to read/write memory that serves as a scratch pad, a temporary place to hold data, partial results, program instructions, etc.

read-only memory (ROM) Computer memory whih can be read, but cannot be written to. The pattern of a ROM is fixed and unalterable and is therefore useful for fixed data, program instructions, etc.

remote computer A central processor at a different location from the terminal used by the operator. A remote computer is often a large mainframe accessed via a modem and telephone connection.

remote terminal A terminal at a different location from the central processor it is accessing.

retrieval The process of searching for, selecting and extracting data contained in a file or files.

screen That part of the surface of a "cathode ray tube" which is visible to the user of a terminal, sometimes synonymous with "page."

scroll To move the contents of a screen up or down, a line at a time.

search The process of identifying a given record before retrieval.

smart terminal A terminal which is capable of a certain amount of processing without using the power of the computer to which it is connected. The processing power of the terminal is available to the user at the terminal end, and he may program the terminal to meet his own needs. There is an implication that a smart terminal has rather less local processing capability than an intelligent terminal.

software All programs written to be executed on hardware, including operating systems, utility programs, and application programs.

synchronous Pertaining to operations performed under the control of equally spaced signals from a clock involved internally with the computer's operations. The term is often important in the transmission/reception specifications for speech adapters.

telecommunication The transmission and reception of data in verbal, coded or pictorial form over radio circuits or transmission lines by the use of electromagnetic signals. Makes possible the access of or interaction with remote computers over telephone lines.

terminal A peripheral device with a visual display and, usually, keyboard, thus allowing data to be output (as screen display or voice output with a speech adapter) and input (through the keyboard). Terminals are dumb, smart or intelligent, depending on the degree of local processing capability.

text The information part of a message, excluding characters or bits needed for the actual transmission of the message.

text editing The process of locating and modifying data already in a file, thus allowing data presented in a raw state to be prepared for printing out in, for example, an appropriate justified column width.

utility program Programs, usually provided by hardware manufacturers or software houses, to carry out standard operations on files; such operations are not related to the specific contents of the files, but are concerned with such routine general activities as transferring data from one medium to another, listing of storage contents, copying files, etc.

word processor A text editing device designed for the preparation, storage and dissemination of text initiated on typewriter-like units. With special software for the purpose and an attached printer, microcomputers can be used as word processors.

New Resource Reported

DEC Talk

Digital Equipment Corporation has announced the development of a voice output module to be available in March 1984. Reportedly it will speak any ASCII text received through the terminal port. It has four voices: adult male/female, child male/female. Speaking rate and intonation patterns to give emphasis may be altered. Speaking rate ranges from 12 to 300 words per minute.

The box measures 18 inches in width, 12 inches in depth, and 4 inches in height. Like the voice output modules described in the Resource Guide, DECtalk has power supply and built-in speaker and connects to a terminal or microcomputer through an RS232 serial port.

Applications anticipated by the company are automated response to telephone inquiries for stock quotations, bank balances, airline schedules, etc. The company also believes it will have applications for training and instructional programs such as self-paced computer learning courses.

Because DECtalk has not yet reached the market, it is not possible to evaluate its potential as a device for computer access by blind operators.

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